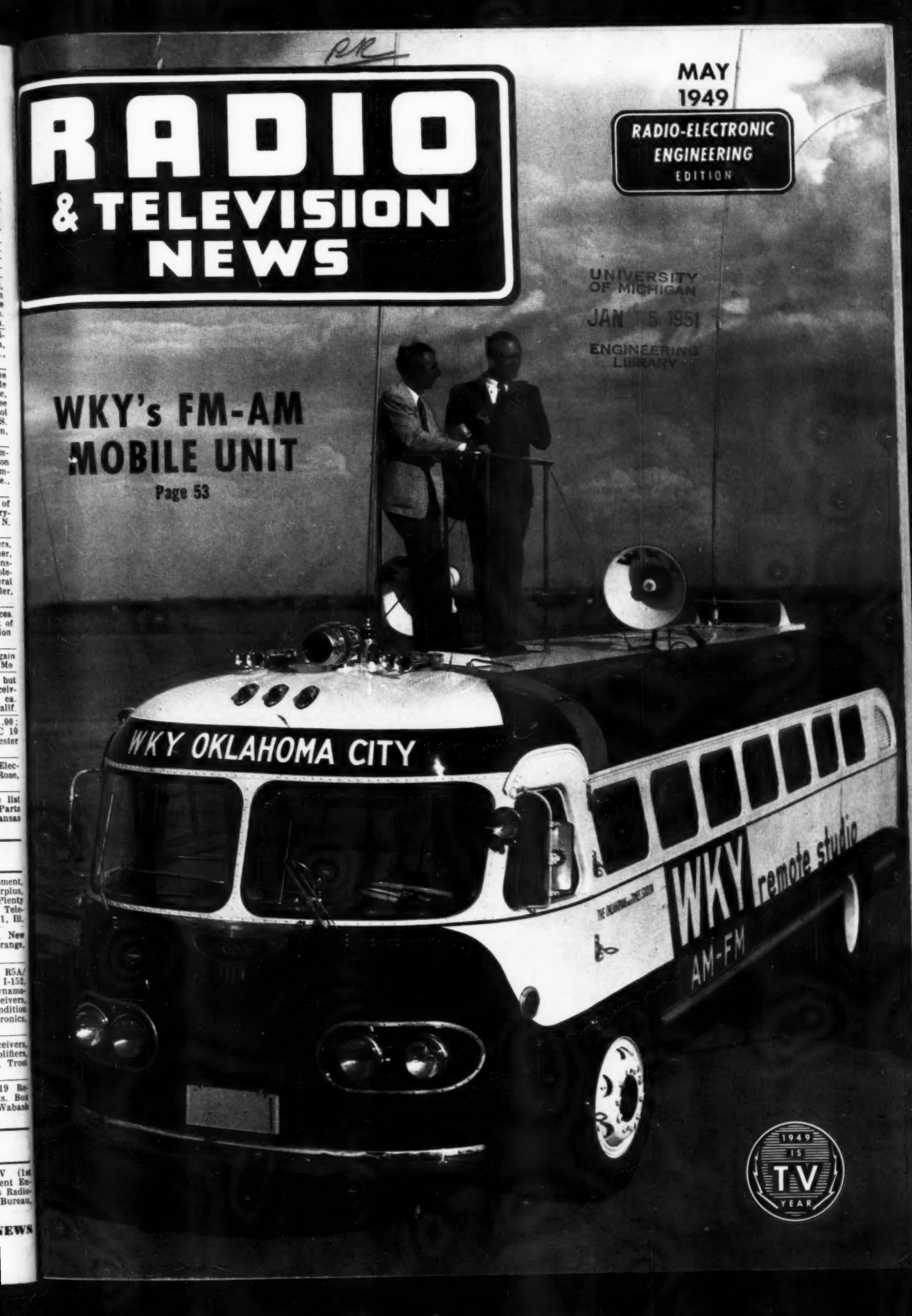
RADIO & TELEVISION NEWS

MAY 1949

RADIO-ELECTRONIC ENGINEERING EDITION

WKY's FM-AM MOBILE UNIT

Page 53



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You get maximum efficiency from a Mallory Vibrator because its related parts are carefully matched. Every part is carefully balanced with its counterpart by an exclusive Mallory method.

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This deal gives you a handsome storage and display cabinet for your stock of vibrators, together with a selection of vibrators and buffer capacitors that will answer 75% of your requirements.

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More Mallory Vibrators are used in original equipment than all other makes combined

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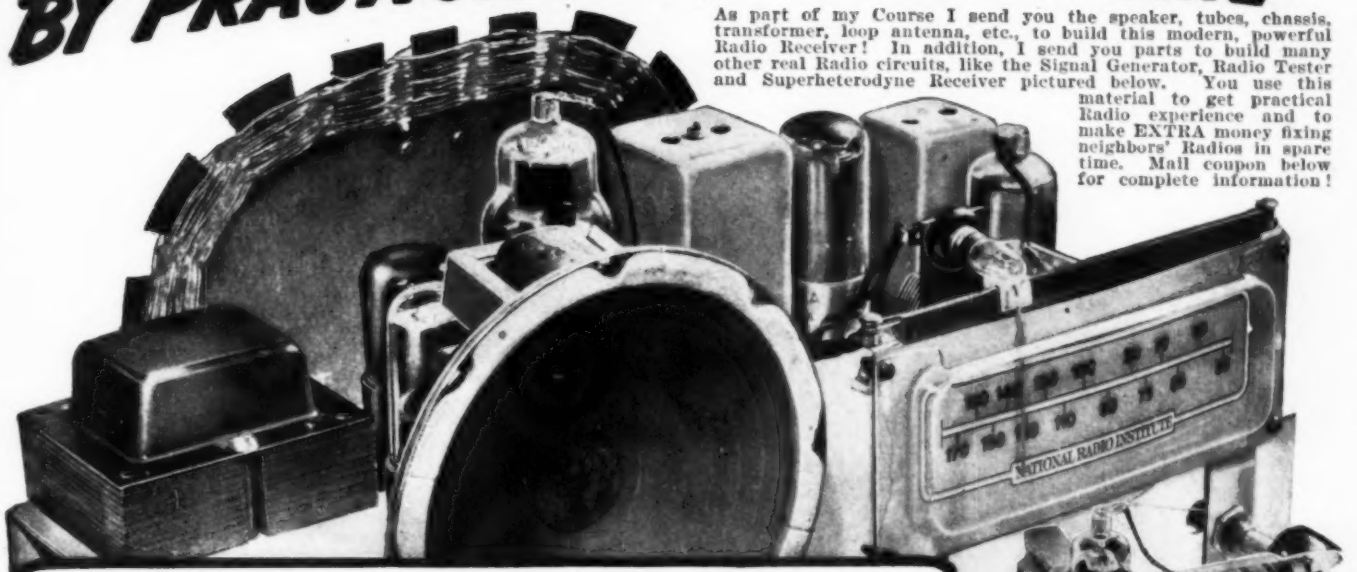
BY PRACTICING IN SPARE TIME

As part of my Course I send you the speaker, tubes, chassis, transformer, loop antenna, etc., to build this modern, powerful Radio Receiver! In addition, I send you parts to build many other real Radio circuits, like the Signal Generator, Radio Tester and Superheterodyne Receiver pictured below. You use this material to get practical Radio experience and to make EXTRA money fixing neighbors' Radios in spare time. Mail coupon below for complete information!



I SEND YOU BIG KITS OF PARTS

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AND MANY OTHER CIRCUITS

J. E. SMITH, President
National Radio Institute

Want a good-pay job in the fast-growing RADIO-TELEVISION Industry? Want a money-making Radio-Television shop of your own? Here's your opportunity. I've trained hundreds of men to be Radio Technicians . . . MEN WITH NO PREVIOUS EXPERIENCE. My tested and proved train-at-home method makes learning easy. You learn Radio-Television principles from illustrated lessons. You get practical experience building, testing, experimenting with MANY KITS OF PARTS I send. All equipment yours to keep.

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Act now! Send for my DOUBLE FREE OFFER. Coupon entitles you to actual lesson, "GETTING ACQUAINTED WITH RECEIVER SERVICING," absolutely free. Over 80 pictures and diagrams! You also get my 64-page book, "HOW TO BE A SUCCESS IN RADIO AND TELEVISION-ELECTRONICS." Tells more about YOUR opportunities, details of my Course, how quickly, easily you can get started. Send coupon in envelope or paste on penny postal. J. E. SMITH, President, Dept. 9ER, National Radio Institute, Pioneer Home Study Radio School, Washington 9, D. C.

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MY COURSE INCLUDES TELEVISION

Good for Both-FREE

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COVER PHOTO: Custombuilt bus-studio on a WKY remote broadcast, complete with AM-FM receiving and transmitting antennas. (Photo courtesy A. Y. Owen, Staff Photographer, Oklahoman and Times)

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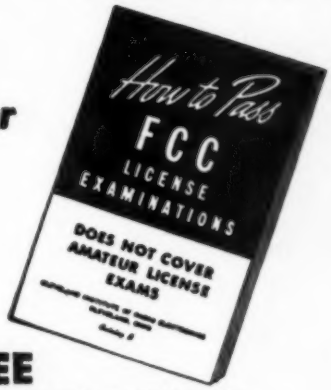
Commercial Radio Operator

I can train you to pass your FCC License Exams in a few short weeks if you've had any practical radio experience—amateur, Army, Navy, radio servicing, or other. My time-proven plan can help put you, too, on the road to success.

Let me send you FREE the entire story

Just fill out the coupon and mail it. I will send you, free of charge, a copy of "How to Pass FCC License Exams," plus a sample FCC-type Exam, and the amazing new booklet, "Money Making FCC License Information."

EDW. H. GUILFORD,
Vice President



FREE

Tells where to apply for and take FCC examinations, location of examining offices, scope of knowledge required, approved way to prepare for FCC examinations, positive method of checking your knowledge before taking the examinations.

Get your FCC ticket in a FEW SHORT WEEKS

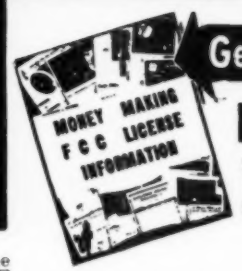
IT'S EASY IF YOU USE CIRE SIMPLIFIED TRAINING AND COACHING METHODS AT HOME IN YOUR SPARE TIME

Get your license easily and quickly and be ready for the $3000 to $7500 jobs that are open to ticket holders. CIRE training is the only planned course of coaching and training that leads directly to an FCC license. Your FCC ticket is recognized in all radio fields as proof of your technical ability. Employers often give preference to license holders, even though a license is not required for the job. Hold an FCC "ticket" and the job is yours!

Look what these students say

"I now hold ticket Number P-10-3787, and holding the license has helped me to obtain the type of job I've always dreamed of having. Yes, thanks to CIRE, I am now working for CAA as Radio Maintenance Technician, at a far better salary than I've ever had before. I am deeply grateful."—Student No. 3319N12.

"I was issued license P-2-11188 on November 4. The next day I was signed on board a tanker as Radio Operator-Purser. Besides radio operating, I handle the payrolls, etc., which is all over-time and brings my monthly pay up to between $400 and $650."—Student No. 2355N12.



Get This Amazing New Booklet

1. TELLS OF THOUSANDS OF BRAND-NEW, BETTER-PAYING RADIO JOBS NOW OPEN TO FCC LICENSE HOLDERS.
2. **TELLS HOW YOU WILL BENEFIT BY HOLDING AN FCC COMMERCIAL LICENSE.**
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4. **TELLS OF HUNDREDS OF OUR SUCCESSFUL STUDENTS WHO NOW HAVE LICENSES AND NEW, BETTER-PAYING JOBS.**
5. **TELLS HOW WE PREPARE YOU TO PASS NOW THE NEW FCC COMMERCIAL LICENSE EXAMINATIONS, WHICH INCLUDE FM AND TELEVISION.**
6. TELLS HOW WE GUARANTEE TO TRAIN AND COACH YOU UNTIL YOU GET YOUR LICENSE.
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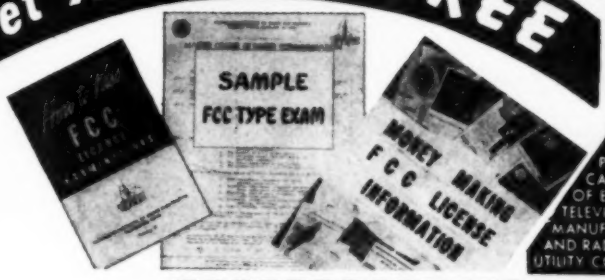

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NO OBLIGATION—NO SALESMEN.

ANNOUNCING . . .

"Three-Sixty" Hypex PROJECTORS

MODEL VR-11 "THREE-SIXTY" HYPEX
(above) *15 WATTS; 280 CPS CUT-OFF.*

MODEL VR-241 "THREE-SIXTY" HYPEX
(at right) *25 WATTS; 140 CPS CUT-OFF.*

TWO *new* Hypex* Projectors—designed for 360-degree sound dispersal—are now available. With sound distributed horizontally in all directions, these new models are intended for installations where coverage of relatively large areas and suspension from the ceiling are desired. Like all Hypex Projectors, these radial units incorporate the famous Hypex formula† which results in improved acoustic performance.

By the addition of the two radials to the four previously announced Hypex units illustrated below, the Hypex line now includes a model for every "sound" need, indoors or outdoors.

Jensen *Hypex*

**Trade Mark Registered* *†Patent 2,338,262*

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Division of the Muter Company
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Write for Data Sheet 143

In Canada: COPPER WIRE PRODUCTS, LTD., 351 CARLAW AVENUE, TORONTO

MODEL VH-24 HYPEX
25 WATTS; 110 CPS CUT-OFF

MODEL VH-20 HYPEX
25 WATTS; 140 CPS CUT-OFF

MODEL VH-15 HYPEX
15 WATTS; 180 CPS CUT-OFF

MODEL VH-91 HYPEX
15 WATTS; 300 CPS CUT-OFF

For the RECORD

BY THE EDITOR

HAM RADIO THREATENED BY NEW SERVICES

Utilities, Television, Citizens Radio to Get New Frequencies

IF YOU, OM were to pick up a newspaper and read such a headline, you would be shocked as never before. You wouldn't believe that such a thing could ever happen to your hobby in a country of free speech and enterprise.

But it CAN happen unless you and I are willing to pitch in and do something about it. Strong words? We think not!

Let's quit kidding ourselves about the future security of our hobby. We, as hams, have always had a good "offensive" team. We have helped our country in times of stress, performed yeoman service when disaster came upon us and considered ourselves to be quite alert and aggressive in matters that are technical and communicationswise.

A strong offense is f.b.—but suppose the other teams have an equal or better offense. Someone's going to eventually lose his punch unless he is blessed with a good "defense."

Building a Defense

Amateur radio's defense depends upon its ability to train new hams and to make replacements as the going gets tougher. It needs the vitality of youth, as well as the wisdom of the coach, if it is to combat the increasing pressure brought to bear by new radio, television, and other services.

We have been told in Washington, for example, that unless we hams occupy and make use of our higher frequencies, they will be assigned to services having greater interest and need for their use.

If we believe that there is strength in numbers, then let's increase our strength by encouraging new hams to join our team. It is the surest way to bolster our defense—in fact the ONLY way.

Too many of us hams are prone to "let George do it." We received a very discouraging report from a scoutmaster in one of our larger cities, telling how he approached the members of a ham club (about 200) for an instructor to teach an enthusiastic group of 50 scouts and 12 of their dads, who sincerely wanted to become hams. In spite of the incentive provided by our $10,000.00 contest, not one amateur present even offered a suggestion—let alone a volunteer to take over 62 prospects who were ready and eager to start their course of instruction.

If this case is typical of the attitude of the American amateur, we hams had better look to our laurels and correct our thinking before it is too late!

Contest Extended to March, 1950

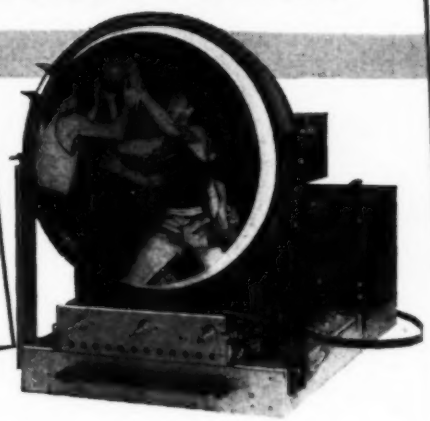
Realization that many trainees and their instructors will be away on vacations during the Summer months and necessarily miss several weeks' study for their licenses prompted us to extend the closing date of our $10,000.00 contest to midnight, March 1, 1950, and to extend Club entries until midnight, April 31, 1949.

In addition, we are adding an alternate choice of U.S. Savings Bonds instead of amateur equipment to the winners, both individuals and clubs, of our $10,000.00 contest.

There it is fellows—your opportunity to build a strong "defense" and a greater security for your hobby, as well as to gain financial rewards for your efforts. Are YOU going to pitch in? . . . . . O. R.

it's ALLIED for hallicrafters!

hallicrafters Model T-64 Television Chassis with exclusive "DUAL-FOCUS" feature



Tops for custom installations at low cost—a factory-built direct-view chassis for 10 or 12-inch tubes. With exclusive new Dual-Focus switch—10" tube gives you choice of big 64 sq. in. telescopic view for dramatic closeups, or large 56 sq. in. full-range view. Either way, you get a sharp picture, with fine stability and superb contrast. Features: 12 channel push-button tuning; RF amplifier; 3 IF amplifiers; 2 video amplifiers; improved sync circuits; AGC; static-free FM audio system. Complete with power supply, speaker and 15 tubes, plus 3 rectifiers. Less picture tube (you can use either 10" or 12" size). For 105-125 volts, 50-60 cycles AC. Shpg. wt., 60 lbs.

97-875. Hallicrafters T-64 Television Chassis. *Only*.... **$169.95**
$33.99 down, $12.01 monthly for 12 months.

6-780. 10BP4 10" picture tube. Shpg. wt., 20 lbs. *NET* .$34.00

7-211. 12LP4 12" picture tube. Shpg. wt., 25 lbs. *NET*...$60.00

97-885. Bracket to permit use of 12" tube with chassis. *NET* .$8.50

hallicrafters S-40A and S-52 All-Wave Receivers

Popularly-priced Hallicrafters communications receivers, packed with advanced features. Cover 550 kc to 43 mc in 4 bands. Highlights include: full electrical bandspread; inertia flywheel tuning; calibrated main dial; automatic noise limiter; adjustable pitch BFO; standby switch; codephone switch; headphone jack; shock-mounted speakers; separate sensitivity and volume controls; 3-position tone control. All tubes included. In handsome all-steel cabinet, 18½"x9"x11". Shpg. wt., 32 lbs.

97-546. S-40A, for 105-125 v., 50-60 cy. AC.

97-588. S-52, for 117 volts AC or DC.

YOUR NET PRICE, EITHER MODEL, ONLY **$99.50**
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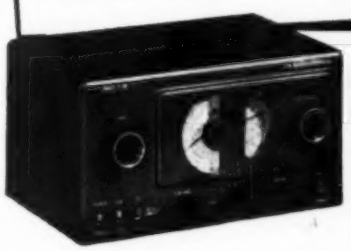

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The all-star, all-wave value that amazes even the experts. Covers 4 full wave bands, continuous range from 540 kc to 32 mc. Features: full electrical bandspread; Noise Limiter; Band Selector; BFO pitch; Voice-Code switch; Speaker-headphones switch; Standby-receive switch; latest PM speaker. In handsome furniture-steel cabinet; 12x7x8". Complete with all tubes. For 105-125 v., 25-60 cy. AC, or 105-125 v. DC. Shpg. wt., 15 lbs.

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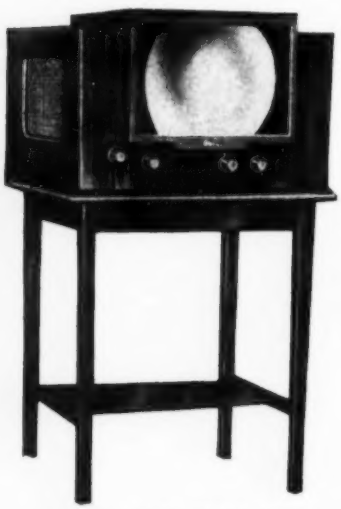
- NO INSTALLATION COST. You can install assembled kit yourself in about an hour.

Indoor Antenna (shown at right) available separately for $7.95



MODEL 12CL TV-FM KIT

200 Sq. In. PICTURE

TV-FM KIT

MODEL 12CL

Has DuMont Inputuner

IMAGE IS EQUAL to that of a 20" tube—even sharper and clearer—visible from all angles.

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- **12½" picture tube** with special fitted built-in All-Angle Lens and color kit.
- DuMont TV-FM Inputuner
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Includes Cabinet, Lens, Table, Indoor or Outdoor Antenna, 60 ft. of Lead-In Wire. **$399**

TRANSVISION Model 15A TV KIT

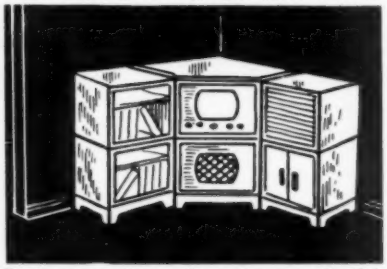
This high-quality Transvision TV Kit has a **15" picture tube.** In all other respects it is the same as the 12A shown above. **$299** Less Cabinet*

*CHOICE of BEAUTIFUL CABINETS from $29

For example, a "Modular" Console Cabinet which can be easily assembled in about an hour, costs $29.

ASSEMBLE Your Own CABINETS

Transvision's "MODULAR" Cabinets come in knock-down, unpainted units, offering an unlimited range of combinations, including even a bar. Finish them off to suit your taste and need.



Corner piece, shown above, has room for T.V., **Phono, Record Storage,** and open **Book Case. COMPLETE** **$84.00**

For other units and prices, write for "Modular" Catalog.

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Improves Installations!!

Saves ½ the Work!!

Has numerous features and advantages, including—(1) Measures actual picture signal strength . . . (2) Permits actual picture signal measurements without the use of a complete television set . . . (3) Antenna orientation can be done exactly . . . (4) Measures losses or gain of various antenna and lead-in combinations . . . (5) Useful for checking receiver re-radiation (local oscillator) . . . (6) **12 CHANNEL SELECTOR** . . . (7) Amplitudes of interfering signals can be checked . . . (8) Weighs only 5 lbs. . . . (9) **Individually calibrated** . . . (10) Housed in attractive metal carrying case . . . (11) Initial cost of this unit is covered after only 3 or 4 installations ....(12) Operates on 110V, 60 Cycles, A.C.

Model FSM-1, with tubes. . . . **Net $99.50**

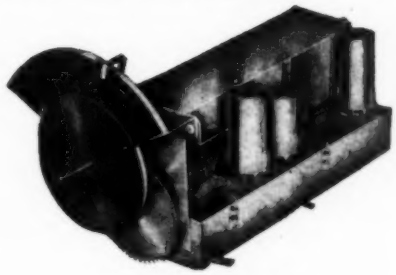
NEW LOW PRICE

TRANSVISION ALL-CHANNEL TELEVISION BOOSTER

CONTINUOUS TUNING

To **assure television reception in weak signal areas,** or areas which are out of range of certain broadcasting stations, Transvision engineers have designed this new booster. It **increases signal strength on all television channels.** Tunes all television channels **continuously.** Can be used with any type of television receiver. Unusually high gain in upper television channels.

Model B-1 . . . . . **List $32.50**



DuMont TV-FM

INPUTUNER

The finest TV-FM Tuner on the market today! Distributed exclusively by Transvision.

- **Covers all 12 channels, entire FM Range.**
- Continuously tunes from **44 to 216 mc without a break.** Requires no band switching for tuning from channel to channel.
- Complete with tubes and escutcheon.

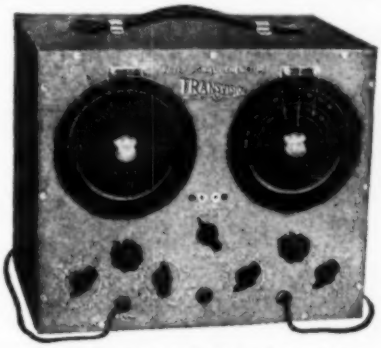
Model IT-1 . . . . . **$59.95**

TRANSVISION ALL-ANGLE LENSES for ALL TV SETS

Give picture sizes up to 150 sq. in. **Exclusive patented feature makes image visible from wide angle.** Lenses come with adapter for installation on ANY 7" or 10" picture tube, and with color kits. **All-Angle Lens** for 7" tubes (gives 75 sq. in. picture) **$25.95**
All-Angle Lens for 10" tubes (gives 150 sq. in. picture) **$37.50**
For 12½" tubes **$49.50**

GET INTO the TV BUSINESS In a BIG WAY with the TRANSVISION DEALER PLAN

WRITE FOR FOLDER D-1



TELEVISION and FM SWEEP SIGNAL GENERATOR

Complete frequency coverage from 0-227 MC with no band switching. . . . Sweep width from 0-12 MC completely variable. . . . Accurately calibrated built-in marker generator.

OUTSTANDING FEATURES: (1) Frequency range from 0-227 MC . . . (2) Dial calibrated in frequency . . . (3) Sweep width from 0-12 MC completely variable . . . (4) Self-contained markers readable directly on the dial to .5% or better. (No external generator required to provide the marker signals) . . . (5) Crystal controlled output makes possible any crystal controlled frequency from 5-230 MC . . . (6) Plenty of voltage output—permits stage-by-stage alignment . . . (7) Output impedance 5-125 ohms . . . (8) Directly calibrated markers, 20-30 MC for trap, sound and video IF alignment . . . (9) RF for alignment of traps for IF channels when a DC voltmeter is used as the indicating medium . . . (10) Unmodulated RF signal to provide marker pips simultaneously with the main variable oscillator . . . (11) Markers can be controlled as to output strength in the pip oscillator . . . (12) Power supply completely shielded and filtered to prevent leakage . . . (13) All active tubes are the new modern miniature type . . . (14) Phasing control incorporated in the generator . . . (15) Operates on 110V, 60 Cycles, AC.

Model SG . . . . . **Net $99.50**

REMOTE CONTROL UNIT KIT

OPERATES ANY TELEVISION SET from a DISTANCE up to 50 feet.

Model TRCU Remote Control Unit Kit with 25-ft. cable **$69.00**
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Please ship the following Transvision Products **THROUGH YOUR NEAREST LOCAL OUTLET:-** RN-5

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(please print)
Address . . . . . State . . . . .

Spot Radio News

★ ***Presenting latest information on the Radio Industry.***

By RADIO & TELEVISION NEWS' WASHINGTON EDITOR

WASHINGTON, once again, has become a technological arena with the very-high and ultra-high TV bands as the featured performers.

Since December, when the famous propagation hearings were held and the subsequent Ad Hoc committee was formed to resolve the divergencies of opinion, industry and government experts have been sparring and marking time until all the possible variables in the allocation problem could be evaluated and a decision formulated. The volumes of statistical information which had to be studied made it difficult to arrive at an immediate satisfactory conclusion, and as a result, armchair specialists became busy and began to arrive at diverse opinions, which were far from complimentary not only to the government bodies but those from industry who were striving to solve an extremely difficult situation, all of which tended to alarm Mr. and Mrs. Public.

Actually the committee has reached a statistical approach, which involves relating the median tropospheric fields to the 4/3 earth's radius value up to distances of about 90 miles. At larger distances, where but few measurements are available and where the median value is in general below the recorder noise level, a single curve was developed which provided the best fit to the measured levels of intensities for one per-cent of the time, irrespective of the frequency and of the height of the transmitting antenna. Measured ratios of the one per-cent and ten per-cent levels, which showed systematic frequency effects, were applied to the one per-cent curve to produce curves of the levels exceeded for ten per-cent of the time for a sequence of frequencies. Families of curves for several antenna heights and frequencies, showing the continuous variation with distance of the field intensities to be expected for various percentages of the time, were produced by a system of smooth transition between the distance ranges involved in the foregoing two approaches.

Now these data are being probed for application to the present standards. The information at this stage has been conclusive enough for FCC Chairman Wayne Coy to state, and most emphatically, that the existing very-high channels will be available for a long, long time, the freeze will be undoubtedly lifted during the first weeks of the summer and some ultra-high stations will probably be operating in the early months of next year. The ultra-high stations, operating on the same channels, are expected to be about 200 to 225 miles apart, Coy stated.

Senator Edwin C. Johnson of Colorado, chairman of the Interstate Commerce Committee and father of the 50-kilowatt AM bill now being debated in Congress, entered the ultra-high battle by writing a letter to FCC Chairman Coy asking that the Commission and the TV industry take steps to protect the public against depreciation of their investments in television receivers when the higher frequencies come into use. As a result of this correspondence, one manufacturer decided to enter the dispute and indicate in advertisements, which appeared nationally, that his equipment could accommodate the higher bands without major alterations. Others in the industry voiced the opinions that present channels will not be obsoleted, basing their remarks on FCC Chairman Coy's assurances, and, therefore, the sets now being sold will continue to receive all stations now on the air or soon to be authorized. These manufacturers also emphasized that conversion of most current receivers for the ultra-highs would offer no particularly difficult technical problems and in most cases will not prove prohibitively expensive, as several in Washington and industry indicated.

Two schools of thought did enter into the experienced experts' probe as to the immediate and future use of the ultra-high bands. In one set of views, expressed at the recent IRE national meeting at the Hotel Commodore in New York City, David B. Smith, vice president in charge of research and engineering at *Philco*, said that the ultra-highs are unlikely for several years and when they do come will not obsolete present TV receivers. Smith based his conclusions on an investigation made by Joseph Fisher of the *Philco* research division, who presented his report at the IRE meeting. According to the Fisher tests, which were made at sixty locations in the area of Washington, at distances of from one-and-a-half to twenty-three miles from the *NBC* experimental transmitter in the Wardman Park Hotel operating in the 504 to 510-mega-

PERFECT MATCH

between Antenna and Receiver!
AT ALL TIMES

INTELIN TV-59

HIGH QUALITY AT LOW COST

Here's the finest lead-in available, at such low cost, for television receivers of 72-Ohm input impedance.

Intelin TV-59 offers a perfect match in impedance—and keeps that characteristic continuously despite the effects of weather and abrasion. This highly desirable *stability*—together with effective shielding—provide maximum signal-to-noise ratio . . . clear and steady television reception.

Federal—America's leading manufacturer of solid dielectric coaxial cables—gave Intelin TV-59 all of the important electrical and physical characteristics of its Intelin RG-59/U—considered the ultimate in 72-Ohm coax lines. And through Federal engineering, manufacturing and testing techniques Intelin TV-59 is now made available to you at a considerable saving in price. For full information, write to Department D-959.

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cycle channel, power requirements in the ultra-highs will have to be much higher than on the lower channels to achieve comparable coverage, probably four to five times more powerful. It was also found that the shadowing effect caused by obstructions such as hills, buildings, and trees is much greater in the higher bands, thus requiring added height for the antenna system. The report then went on to reveal that at least three years or longer would be required before transmitters with the required high powers could be built.

According to Fisher it was found possible to receive satisfactory signals on the ultra-highs with a simple three-tube converter and a standard television model. During the tests three types of receiving antennas were used and mounted on a station wagon. These were a half-wave dipole, four-element Yagi and eight-element array with a screen reflector, each of which at one time or another was extended to a height of thirty-five feet. The antennas were connected to the input of the converter by means of a double shielded 93-ohm coaxial transmission line. The converter used a tuned coaxial input circuit feeding into a 1N21C crystal. The i.f. frequency of the converter was 54 to 60 megacycles.

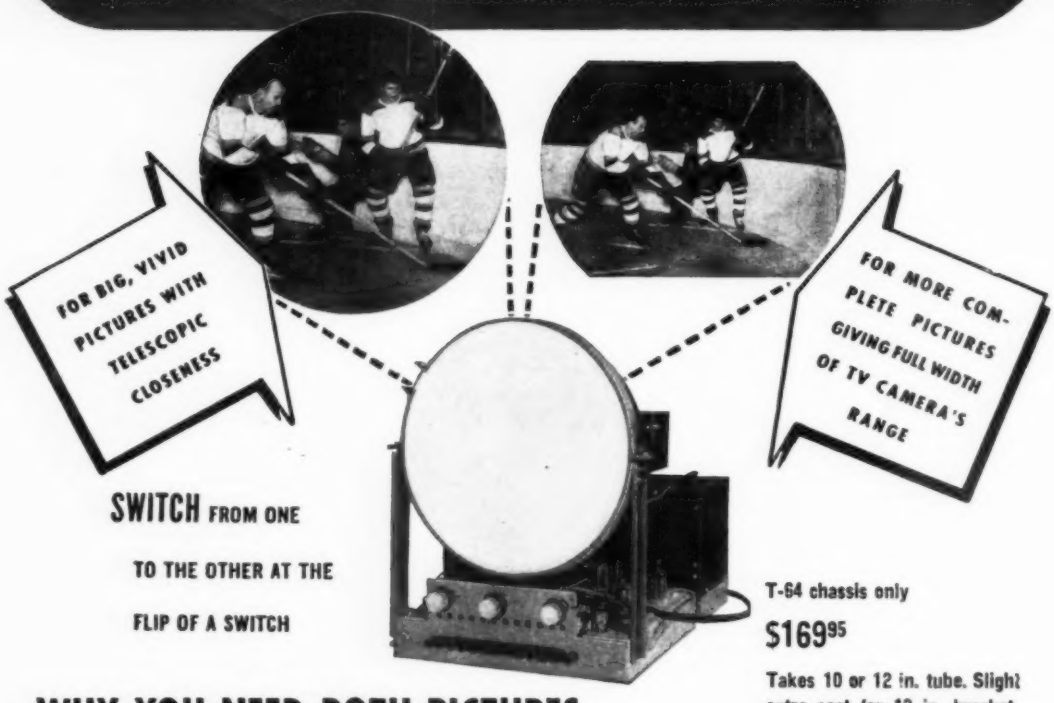
In addition to the 500-megacycle tests in Washington, propagation measurements were made in the Philadelphia area, using a 20-kilowatt, 3300-megacycle one-microsecond pulse transmitter with a directional transmitting antenna.

In a contrary opinion and IRE report, Dr. Thomas T. Goldsmith, director of research for *Du Mont*, declared that ultra-high transmitters could be made available probably within a year. Goldsmith did agree with Fisher and Smith as to the successful use of converters and the fact that obsolescence of the present receivers would not be a factor, when the ultra-highs were authorized.

The implication that the ultra-highs may not be too far in the offing was also expressed in an *RCA* engineering report, which revealed the development of a method of combining transmitting tubes in groups or clusters, which could materially increase the power of television stations operating anywhere from 300 to 3000 megacycles. Describing the method at the IRE meeting, G. H. Brown, W. C. Morrison, W. L. Behrend and J. G. Reddick of the *RCA* labs, said that two tubes, or two complete transmitters, are teamed through a special network called a duplexer, which permits the combined outputs of the tubes to be fed into the same antenna, thereby doubling the effective power output, without narrowing the width of the band transmitter. It was stated that a transmitter with four output stages, combined with three duplexers, had been built. With the four stages operating at 850 megacycles, the final output of the transmitter was found to be four times the power obtained from a sin-

(*Continued on page* 152)

DUAL FOCUS Steals The Show with TWO Pictures Instead of ONE



T-64 chassis only

$169.95

Takes 10 or 12 in. tube. Slight extra cost for 12 in. bracket.

WHY YOU NEED BOTH PICTURES

For complete enjoyment of circular-picture television, you need both the circular picture and the rectangular picture. The larger picture is truly a joy to behold, *but*—it clips off the sides of the normal picture. It works like a telescope; it concentrates on a smaller area and magnifies it. You see *less*, but what you do see appears *bigger* and *closer*. However, if reading material is flashed on the screen, the circular view may not cover the full width of the lines. Then, of course, with Hallicrafters, you merely flip the switch back to the rectangular picture.

HALLICRAFTERS IS EXPANDED BOTH WAYS

In going from the rectangular to the circular picture, both height and width are blown up together to maintain normal proportions. This avoids the excessive distortion by vertical elongation as seen on early model sets with circular pictures.

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Mails coupon to National Schools in Los Angeles, and receives Free Lesson and book of information about Radio, Television and Electronics training.

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Applies for—and GETS—a good pay, full time job in industry. Finds that employers know National Schools and like to hire their graduates.

Or he opens own profitable Service Shop, with valuable counsel and aid from National Schools. Now for real happiness and success!

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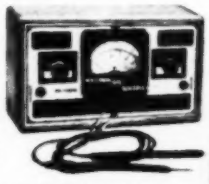

Professional Multitester Included!

This portable instrument (see right) enables you to perform many practical tests, make delicate adjustments and do service work. Complete with test leads.

You receive a series of special laboratory experiment lessons to guide your practical exercises with your equipment. These lessons have been prepared with a special technique of illustrating radio principles by numerous easy-to-understand examples.

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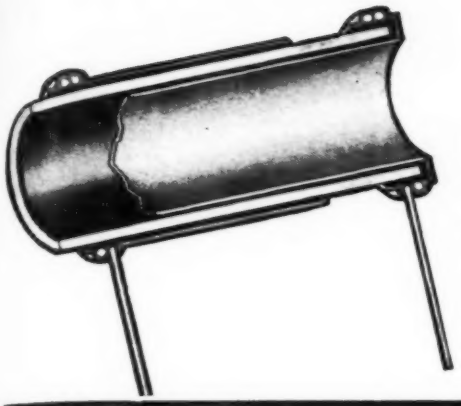
SEE THESE "HI-KAP" VALUES AND PRICES

PART NUMBER	VALUE (MFD)	LIST PRICE*
D6-100	.00001	$1.25*
D6-150	.000015	1.25*
D6-250	.000025	1.25*
D6-400	.00004	1.25*
D6-500	.00005	1.25*
D6-101	.0001	1.25*
D6-151	.00015	1.25*
D6-201	.0002	1.25*
D6-251	.00025	1.25*
D6-301	.0003	1.25*
D6-401	.0004	1.25*
D6-501	.0005	1.25*
D6-751	.00075	1.25*
D6-102	.001	1.25*
D6-152	.0015	1.25*
D6-202	.002	1.25*
D6-252	.0025	1.25*
D6-502	.005	1.50*
D6-752	.0075	1.50*
D6-103	.01	1.50*

*Per Envelope of 5

Rating: 600 WVDC — 1000 V. flash tested. Individually color coded, inspected and insulated.



Never before has the dependability, permanence and convenience of ceramic by-pass and coupling capacitors been offered to Radio Service Dealers at a favorable price!

"HI-KAP" FEATURES	DESCRIPTION			ADVANTAGES
1. Impervious to moisture	Ceramic-X is non-hygroscopic. Moisture absorption is .007% or less.			No deterioration, no shorting. Longer life even under the most adverse conditions.
2. Low mass weight	Av. Wt.	Dimensions	Values	For unit size and weight, Centralab BC "Hi-Kaps", made with Ceramic-X, are the only capacitors on the market which provide these voltage ratings.
	.029 oz.	D—.315" L—.540"	.00005—.00025 mfd.	
3. Small size	.044 oz.	D—.315" L—.830"	.0005 mfd.	
	.050 oz.	D—.340" L—1"	.000750—.005 mfd.	
4. High capacity	.082 oz.	D—.400" L—1.305"	.01 mfd.	
	Rating: 600 WVDC — 1000 VDC flash test.			
5. Special insulation	Wax impregnated, lacquered, dipped in special phenolic resin, cured and wax impregnated.			Prevents any possibility of shorting to adjacent leads, chassis or components.
6. Convenient side leads	Heavy #22 gauge tinned copper.			Permit rapid, close-coupled connections. No tricky bending or fitting required.
7. Low power factor	Initial — .6%. After 100 hours, 95% humidity test — 3.0%.			More efficient circuit operation, fewer failures.
8. High leakage resistance	Initial — 5000 megohms. After humidity —500 megohms.			Long life, more efficient performance.
9. Maximum dependability	One-piece construction. Leads soldered directly to electrodes.			Will not short or become intermittent.
10. Factory tested	For your protection, all units 100% factory tested before packaging and shipping.			Your guarantee to your customers of reliable service and performance.

See your Centralab Distributor for complete information on this new line of ceramic by-pass and coupling capacitors, or write direct to

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DIVISION OF GLOBE-UNION INC., MILWAUKEE, WIS.

TELEVISION SET SHIPMENTS BY AREAS

Television Broadcast Service Area	Accumulative (1947 & 1948)
ALABAMA	
Birmingham	23
ARKANSAS	
Little Rock	19
Other Cities	42
CALIFORNIA	
Fresno	11
Los Angeles	75,250
Long Beach	554
Oakland	60
Santa Barbara	201
San Diego	536
San Francisco	11,665
Other Cities	1,157
COLORADO	
Denver	37
CONNECTICUT	
Bridgeport	2,039
Hartford	11,492
New Britain	144
New Haven	2,012
Waterbury	117
Other Cities	688
Cities not stated	580
DELAWARE	
Wilmington	2,724
Other Cities	7
DISTRICT OF COLUMBIA	30,338
FLORIDA	
Miami	789
Tampa	44
Cities not stated	54
GEORGIA	
Atlanta	4,455
Other Cities	376
ILLINOIS	
Chicago	72,345
Moline	26
Peoria	365
Rockford	82
Rock Island	20
Sterling	37
Tuscola	16
Other Cities	733
INDIANA	
Gary	2,261
Fort Wayne	47
Hammond	214
Indianapolis	423
South Bend	1,429
Cities not stated	160
Other Cities	206
IOWA	
Madison	42
Other Cities	6
KANSAS	9
KENTUCKY	
Louisville	2,897
Other Cities	57
Cities not stated	165
LOUISIANA	
New Orleans	3,970
Other Cities	13
MAINE	14
MARYLAND	
Baltimore	27,885
Other Cities	375
MASSACHUSETTS	
Boston	29,095
Cambridge	3,797
Springfield	159
Taunton	48
Worcester	994
Other Cities	265
Cities not stated	321
MICHIGAN	
Detroit	25,942
Grand Rapids	148
Pontiac	24
Other Cities	222
MINNESOTA	
Minneapolis-St. Paul	6,223
Other Cities	13
MISSISSIPPI	30
MISSOURI	
Kansas City	502
St. Louis	15,849
Other Cities	76
NEBRASKA	31
NEW HAMPSHIRE	
Manchester	309
Other Cities	48
NEW JERSEY	
Atlantic City	1,109
Camden	11
Irvington	587
Jersey City	286
Newark	87,459
New Brunswick	21
Paterson	1,864
Runnemede	13
Trenton	5,101
Newark-Trenton	2,155
Cities not stated	6,579
Other Cities	5,128
NEW MEXICO	
Albuquerque	248
NEW YORK	
Albany	11,933
Binghamton	53
Buffalo	8,687
Long Island	9,986
Middletown	153
Newburgh	34
New Rochelle	110
New York City	256,873
Poughkeepsie	813
Rochester	65
Schenectady	491
Syracuse	1,734
Tarrytown	33
Utica	66
Westchester	1,486
Other Cities	683
Cities not stated	729
NORTH CAROLINA	
Charlotte	219
Other Cities	12
NORTH DAKOTA	1
OHIO	
Akron	1,565
Canton	186
Cincinnati	9,617
Cleveland	19,462
Columbus	22
Dayton	1,763
Toledo	5,349
Youngstown	142
Other Cities	843
OKLAHOMA	
Oklahoma City	18
Other Cities	10
OREGON	
Portland	125
Other Cities	9
PENNSYLVANIA	
Allentown	2,147
Easton	46
Erie	303
Harrisburg	201
Hazeltine	103
Lancaster	285
Philadelphia	98,369
Pittsburgh	5,652
Pottsville	144
Reading	1,449
Sunbury	119
Williamsport	31
Other Cities	838
RHODE ISLAND	
Providence	3,266
Other Cities	1,115
TENNESSEE	
Chattanooga	15
Knoxville	19
Memphis	3,057
Nashville	40
Other Cities	30
TEXAS	
Dallas	3,982
El Paso	163
Fort Worth	2,093
Houston	2,047
Other Cities	249
Cities not stated	175
UTAH	
Salt Lake City	977
Cities not stated	24
VERMONT	3
VIRGINIA	
Alexandria	15
Norfolk	286
Richmond	2,846
Other Cities	173
WASHINGTON	
Seattle	4,450
Tacoma	47
Other Cities	72
WEST VIRGINIA	
Clarksburg	41
Wheeling	87
Other Cities	29
WISCONSIN	
Madison	98
Milwaukee	12,859
Other Cities	80
AREAS NOT DETERMINED	29,037
TOTAL SHIPMENTS	964,206

(Editor's Note: The figures herein are presented through the courtesy of the Radio Manufacturers' Association (RMA). In view of the fact that not all television set manufacturers are members of RMA, add approximately 10 per-cent to all of the figures above. Admiral Radio Corporation for one, and all kit manufacturers, do not belong to RMA, and their production of sets accounts for at least 10 per-cent additional.)

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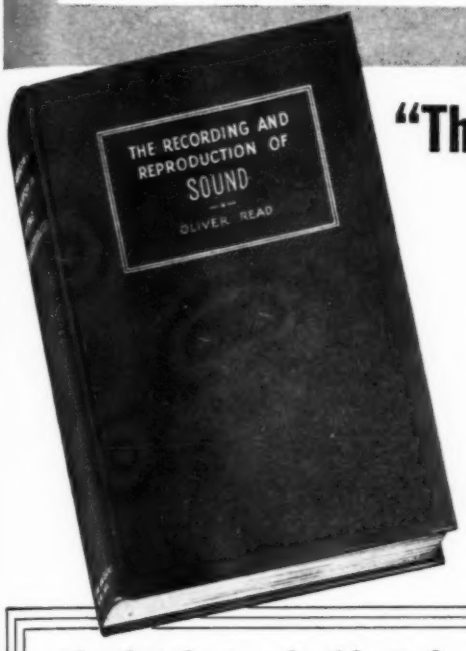

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Name.....

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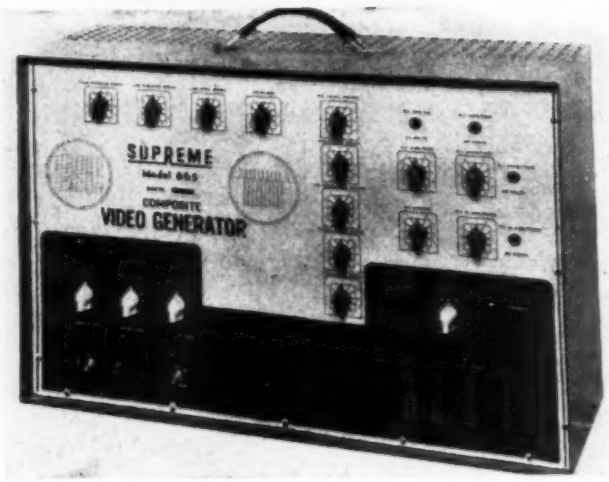
TWO NEW TV TESTERS

SEE THEM AT OUR BOOTH
No. 118. R.M.A. PARTS SHOW
CHICAGO MAY 17 TO 20

MODEL 665



MODEL 660

COMPOSITE VIDEO GENERATOR

- INSTALLATION AND REPAIR WITHOUT STATION TEST PATTERN OPERATION.
- PROVIDES COMPLETE COMPOSITE VIDEO SIGNAL.
- PROVIDES BOTH HORIZONTAL AND VERTICAL SYNC AND BLANKING PULSES—SAME AS TV STATION OPERATION.
- PROVIDES DOT MODULATION FOR ADJUSTMENT OF HORIZONTAL AND VERTICAL LINEARITY AND HOLD CIRCUITS—ADJUSTMENT OF DEFLECTION YOKE AND FOCUS COILS.

TELEVISION OSCILLOSCOPE

- EXTRA SENSITIVE AMPLIFIERS. FIVE TIMES AVERAGE SENSITIVITY.
- WIDE BAND AMPLIFIERS. 10 CYCLE TO 5 MEGACYCLES.
- Z AXIS AMPLIFIER. PROVIDES AMPLE SIGNAL FOR GRID MODULATION OF CATHODE RAY TUBE.
- WIDE RANGE SWEEP GENERATOR FOR TIME BASE. UP TO 150,000 CYCLES.

The Model 665 Composite Video Generator and the Model 660 Television Oscilloscope provide a pair of testers whereby "Signal Tracing" in television sync separation, sweep circuits, and video amplifiers can be made without frequency distortion. SEE THIS NEW TEST SYSTEM.

ANOTHER 1ST!

BY SUPREME

SUPREME
INCORPORATED

You'll Satisfy More Customers With OLIN Flat Cell "B" Batteries . . . The Only Radio Batteries Whose Cells Are

INTERLOCKED

LOOK WHAT IT MEANS

Each cell holds more power-producing chemicals with no waste space.

Triple sealing, under fixed pressure, insures against power leakage.

Up to 91% fewer soldered connections greatly reduce battery "hum" or failure—give longer life.

We guarantee these . . . the ONLY radio batteries with INTERLOCKED flat cells . . . to give more listening hours, and clearer reception under normal conditions.

SEE HOW IT'S DONE

Note in the magnified view showing the enlarged cut-away section how each cell is INTERLOCKED . . . Patented U. S. Pat. No. 2416576.

CHECK THE PRINCIPLE

Interlock your fingers. Then even a strong man would have difficulty pulling your hands apart. This is simple proof of the power of *interlocking* . . . the same principle which is used to make OLIN "B" flat cell batteries the strongest and therefore the longest lasting radio batteries . . . the ONLY batteries that have triple-sealed, equally-strong INTERLOCKED flat cells instead of cells bound together with paper tapes or the other type wrappings found in ordinary batteries.

Available Only In The WINCHESTER TRADE-MARK and BOND Lines

of OLIN INDUSTRIES, INC., Electrical Division, New Haven 4, Connecticut

FAST SHIPMENTS FROM FIVE STOCK WAREHOUSES

Houston, Texas . . . . . East Alton, Illinois . . . . . Chicago, Illinois

San Francisco, California . . . . . Los Angeles, California

MR. RETAILER: Order From Your Wholesaler's Salesman Today To Be Ready For The Vacation Selling Season!

Within the INDUSTRY

HOFFMAN RADIO CORPORATION, during a luncheon meeting held recently in its main plant, honored Max Balcom, president of the Radio Manufacturers Association. Some 32 members of the West Coast Electronic Manufacturers Association were in attendance.

Mr. Balcom, also vice-president of *Sylvania Electric Products, Inc.,* was welcomed by H. Leslie Hoffman, president of *Hoffman Radio.* Principal speaker at the luncheon, the RMA head expressed confidence regarding the growing future of the television industry, with particular emphasis on the West Coast TV picture. He stressed the fact that television must be sold for what it really is—a medium of entertainment for bringing home and family together. He also stated that the East needs the cross-continent coaxial cable link as much as the West, as it will make available outstanding Western talent.

The meeting closed with a get-together of the Electronics group, founded by Mr. Hoffman, its first president.

* * *

JOHN HOLLISTER POTTS of New York City, president of *Radio Magazines, Inc.,* died March 16, at the age of 56.

Mr. Potts was a descendant of John Potts, founder of Pottstown, Pa. He was born in Chicago and graduated from the University of Chicago, with a degree in electrical engineering. During his career, he worked with the *Radio Corporation of America,* the *Sperry Gyroscope Company,* and other firms in engineering capacities. He also served *John F. Rider Publishers, Inc.,* and was technical editor of RADIO NEWS.

* * *

CHARLES K. HOOPER is the new advisory engineer for the Electronics and x-ray division of the *Westinghouse Electric Corporation,* Baltimore, Maryland.

A graduate of the University of Maine, Mr. Hooper has been associated with *Westinghouse* for the past sixteen years, where he was concerned with the design and application of motors, generators, and other forms of rotating electric power equipment. More recently he has been engaged in the application and design of power supplies and controls for use in the electronics industry.

* * *

REMINGTON RADIO CORPORATION, White Plains, New York, has acquired an additional 16,000 square feet of space to further its plans to substantially increase present production.

The space is located in White Plains, in a building apart from the present operations and will serve the company by providing more room for the cabinet department. One section, however, will be turned over to assembly.

The *Remington Radio Corporation* is the manufacturer of Rembrandt Television receivers.

* * *

ROBERT D. ESSIG, a graduate of the University of Michigan, is currently an engineer in the Broadcast Engineering Department of the *Collins Radio Company.*

Mr. Essig joined the *Collins* organization in 1947 following a period when he was an engineer for the University of Michigan Broadcasting Service. Prior to that he had served as assistant technical supervisor for the American Forces Network of broadcast stations while with the occupation forces in Germany.

An associate member of the IRE, Mr. Essig is also a member of the Armed Forces Communications Association, and a 1st Lieutenant in the Signal Corps Reserve.

* * *

JOHN B. WALT, who has been in sales promotion work in the Chicago area since 1937, has been appointed assistant advertising manager of *Admiral Corporation,* it was announced by the advertising director, **SEYMOUR MINTZ. DORMAN D. ISRAEL,** executive vice-president of *Emerson Radio & Phonograph Corporation,* was made a Fellow of the American Institute of Electrical Engineers, at a recent meeting of the engineering organization. *Frederick Hart & Company, Inc.,* manufacturer of electronics equipment, has acquired a new vice-president in the election of **JAMES F. BREHM** to that office. At a meeting held in February, the board of directors of *Lear, Incorporated,* elected **D. W. HAVEN** as treasurer; at present, Mr. **HAVEN** is comptroller and will retain his duties in that capacity. The appointment of **W. WESLEY BALLARD** to the post of director of publicity and advertising, communications division, has been announced by *Motorola, Inc.* The new assistant advertising manager of the *Philco Corporation* is **EDWARD B. BAILEY,** who will serve as executive assistant to **JOHN F. GILLIGAN,** advertising manager. **WILLIAM E. NEILL** will be the sales engineer of the television

IN A RADIO SET

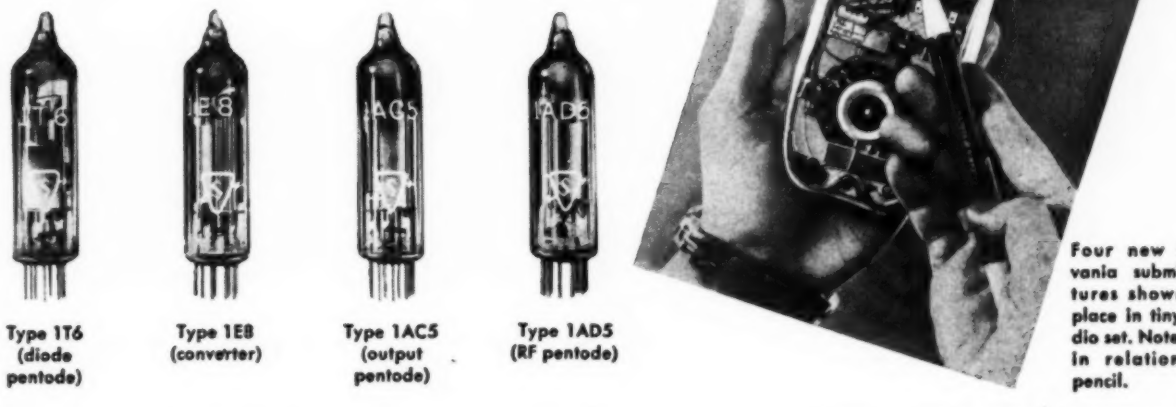
how small can you get?

Sylvania's four tiny new tubes hold the answer

The miniature radio set shown here is an example of what can be done through the use of Sylvania's new subminiature tubes.

These specially designed and engineered T-3 subminiatures are battery-type receiving tubes perfect for very small radios or amplifiers. Short tube leads provided in conventional pin arrangement permit these tubes to be plugged into appropriate subminiature sockets. They can be operated over a wide range of battery voltages. Low current requirements result in battery economy.

Send for complete ratings and characteristics. Sylvania Electric Products Inc., Advertising Dept., R-1005, 500 Fifth Ave., New York 18, N. Y.



Type 1T6 (diode pentode)

Type 1E8 (converter)

Type 1AC5 (output pentode)

Type 1AD5 (RF pentode)

Four new Sylvania subminiatures shown in place in tiny radio set. Note size in relation to pencil.

SYLVANIA ELECTRIC

RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES, SIGN TUBING; LIGHT BULBS; PHOTOLAMPS

and microwave engineering department of *Raytheon Manufacturing Company*, Waltham, Mass., bringing sixteen years' experience in radio broadcasting and VHF radio communications to that capacity. *Technical Appliance Corporation*, manufacturers of *Taco* radio and TV antennas, has announced that its new chief engineer will be **KENDRICK H. LIPPITT**, formerly associated with George C. Davis, broadcast radio consultant in Washington, D. C.

* * *

RALPH V. LITTLE, JR., is presently supervisor of *RCA*'s Theater Television Engineering Group and is now active in the development of theater TV equipment by the direct projection and intermediate film processes and the development of equipment for making television recordings on 16 mm. film.

Mr. Little, a graduate of Pennsylvania State College with a degree of Electrical Engineering, joined *RCA* in 1933 and was assigned to the testing of transmitter and television equipment. He was transferred to the Television Engineering staff in 1939, and while with this group contributed to the development of portable television equipment.

* * *

CHET JORDON and **MAX LIEBMAN** have been appointed district sales managers in the respective territories of lower Manhattan and Queens County, New York, to handle the *Air King* line of radio and television receivers. **WALTER T. MORELAND** will succeed **WILLIAM E. SKINNER** as *Arvin* district manager for Texas and the southwest territory, following Mr. Skinner's appointment as manager of *Arvin Distributors*, the company's new factory branch operation in Chicago. **ROWLAND R. GUILDFORD** is the new assistant sales manager of the *Allen B. Du Mont Laboratories, Inc.*, television receiver division, and will work closely with **VICTOR E. OLSON**, sales manager, in the direction of *Du Mont* receiver sales policies. *Garod Electronics Corporation* announces the following territorial distributors for its line of "Tele-Zoom" receivers: **GENERAL DISTRIBUTORS**, Wheeling, West Virginia; **THE HARGIS COMPANY**, Austin, Texas; **MONITOR DISTRIBUTING CO.**, East Providence, R. I.; **SILKWORTH DISTRIBUTORS, INC.**, Ypsilanti, Michigan; and **W. E. TITUS WHOLESALE CO.**, Oklahoma City 2, Oklahoma. Recent *Emerson Radio & Phonograph Corporation* appointments include **STANLEY M. ABRAMS** as the new sales manager of the television division, **HAROLD E. KARLSRUHER** as head of the home radio division, **ARTHUR N. GROSSBERG**, assistant sales promotion manager, and **GERALD LIGHT** as assistant to the vice-president in charge of sales. —30—

"Madame X" was the code name, during research and development, for an entirely new system of recorded music . . . perfected by RCA.

The remarkable background of "Madame X"

Now the identity of "Madame X," the *unknown* in a long search for tone perfection, has been revealed. From this quest emerges a completely integrated record-playing *system*—records and automatic player—the first to be entirely free of distortion to the trained musical ear . . .

The research began 11 years ago at RCA Laboratories. First, basic factors were determined—minimum diameters, at different speeds, of the groove spiral in the record—beyond which distortion would occur; size of stylus to be used; desired length of playing time. From these came the mathematical answer to the record's *speed*—45 turns a minute—and to the record's size, only 6⅞ inches in diameter.

With this speed and size, engineers could guarantee 5⅓ minutes of distortion-free performance, and the finest quality record in RCA Victor history!

The record itself is non-breakable vinyl plastic, wafer-thin. *Yet it plays as long as a conventional 12-inch record.* The new RCA Victor automatic record changer accommodates up to 10 of the new records—1 hour and 40 minutes of playing time—and can be attached to almost any radio, phonograph, or television combination.

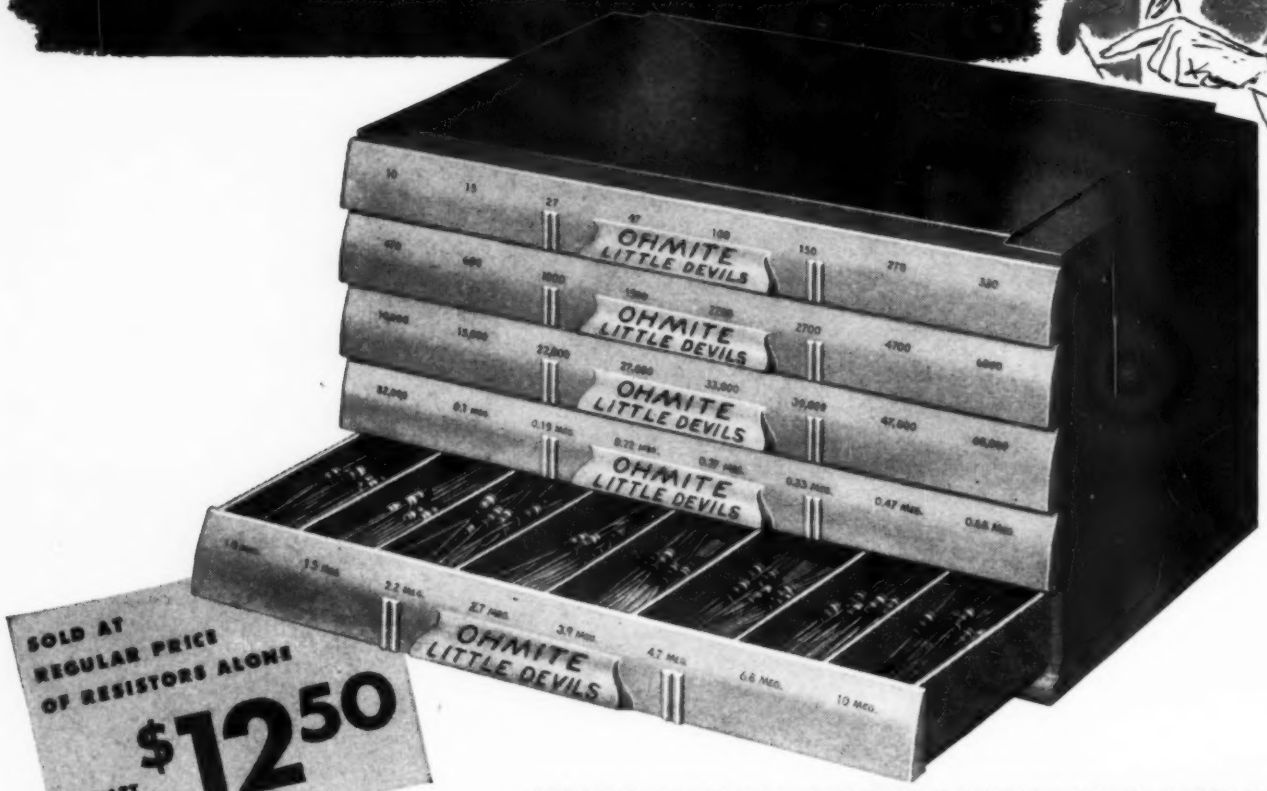
Not only records are free of surface noise and distortion—the record player eliminates faulty operation, noise, and cumbersome size. Records are changed quickly, quietly . . . RCA Victor will continue to supply 78 rpm instruments and records.

This far-reaching advance is one of hundreds which have grown from RCA research. Such leadership adds *value beyond price* to any product or service of RCA and RCA Victor.

RADIO CORPORATION of AMERICA

World Leader in Radio—First in Television

"This OHMITE Resistor Cabinet Saves You Time and Money!"



SOLD AT REGULAR PRICE OF RESISTORS ALONE

$12.50

½-WATT ASSORTMENT

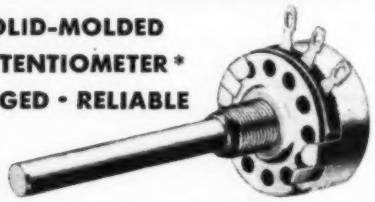
NO CHARGE FOR CABINET

SEE YOUR DISTRIBUTOR

HANDY, NEW ALL-PLASTIC CABINET WITH A SELECTED ASSORTMENT OF 125 "LITTLE DEVIL" RESISTORS

Molded of solid plastic, this rugged compact cabinet—9"x4¾"x5¼"—has 40 compartments factory packed with the "Little Devils" (from 10 ohms to 10 megohms) most frequently used. You find the *right* resistor...*fast.* Check inventory at a glance. And pay nothing extra for it—only regular price of resistors.

SOLID-MOLDED POTENTIOMETER * RUGGED • RELIABLE



Built to last, this Type AB potentiometer has a heat-treated, solid-molded resistance element —not just a film. Unaffected by heat, cold and moisture. Has a 2-watt rating, good safety factor.

INDIVIDUALLY-MARKED "LITTLE DEVIL" COMPOSITION RESISTORS*

Both color coded and individually marked for quick, sure identification, these sealed and insulated resistors are available in Standard RMA values. ½, 1, and 2 watts. Tol. ±10% and ±5%.

* *So that two exceptionally high-quality products will be universally obtainable, Ohmite Manufacturing Company, in co-operation with the Allen-Bradley Company, has arranged for the Type AB (Allen-Bradley Type J) control and Little Devil Molded Composition Resistors (Allen-Bradley Types EB, GB, and HB) to be available from stock at Ohmite distributors.*

OHMITE MFG. CO. 4884 Flournoy St., Chicago 44, Ill. ***Write for Catalog 21***

Be Right with OHMITE

RHEOSTATS • RESISTORS • TAP SWITCHES • CHOKES • ATTENUATORS

MORE HOURS OF SERVICE

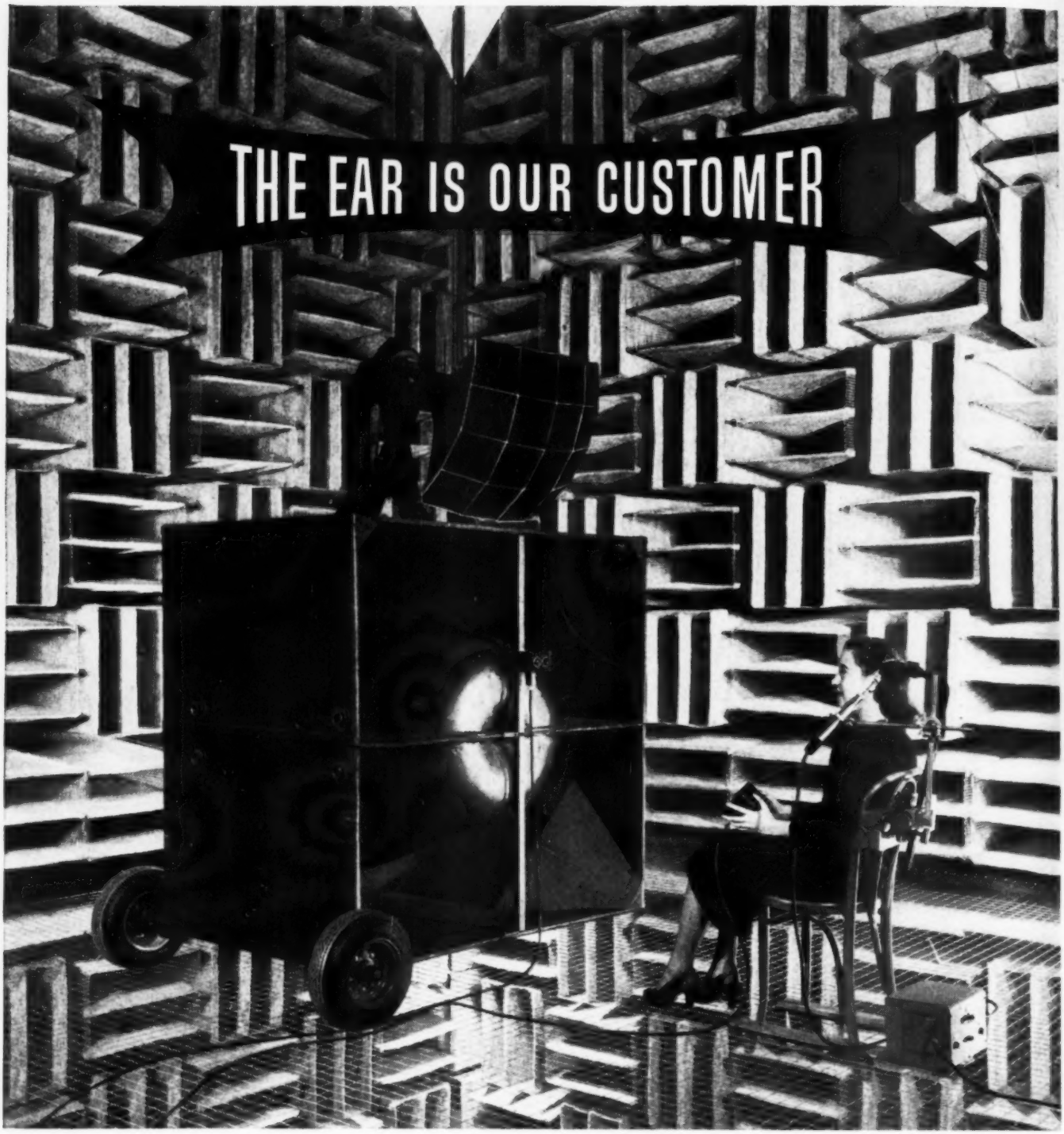
•

MICROPHONE CABLES

•

Every Type for Every Service

Belden *Radio* **WIRE**



What happens when you hear? What happens *inside* your ear when sound waves come in from a telephone conversation?

Bell Telephone Laboratories scientists have developed special apparatus to help answer these questions, for the telephone system is designed to meet the ear's requirements for good listening.

In the test pictured above, the young lady sits before loudspeakers in a soundproofed room with a small hollow tube, reaching just inside the ear canal. Sounds differing slightly in frequency and intensity come from a loudspeaker. The subject seeks to tell one from another, recording her judgment electrically by pressing a switch.

Meanwhile, the same sound waves pass down the hollow tube to a condenser microphone, and a record is made of the exact sound intensities she identified. Results help reveal the sound levels you can hear clearly and without strain—the sounds your telephone must be designed to carry.

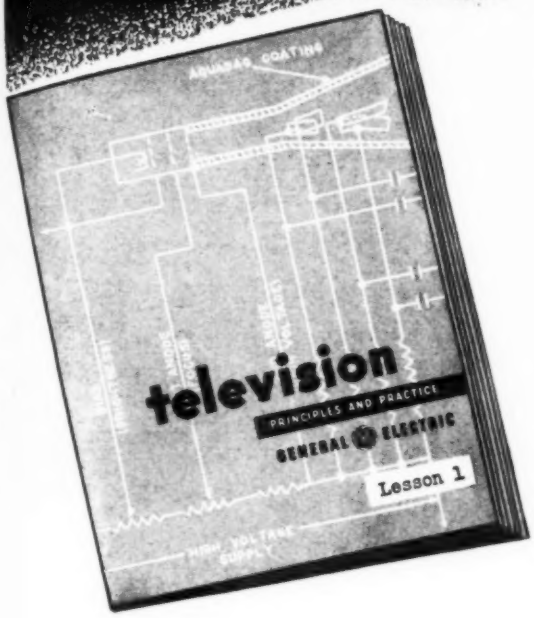
Scientists at Bell Telephone Laboratories make hundreds of tests in this manner. It's just one part of the work which goes on year after year at the Laboratories to help keep Bell System telephone service the finest on earth.

BELL TELEPHONE LABORATORIES

Exploring and inventing, devising and perfecting, for continued improvements and economies in telephone service.

IN RADIO AND TELEVISION TUBE SALES

1949 IS A G-E YEAR!



Biggest news of the year: General Electric's TV-service course! Jampacked with profit possibilities for you and other tube dealers to whom television—the miracle market—offers peak rewards.

It's all here, in this book and those that follow—the basic theory of television; how TV receivers operate; the tubes and other components; how to install and repair sets of various types to their owners' satisfaction and your profit. Each lesson of the series is a clear, straightforward explanation of some one phase of television . . . *plus* a searching list of questions for you to answer after study.

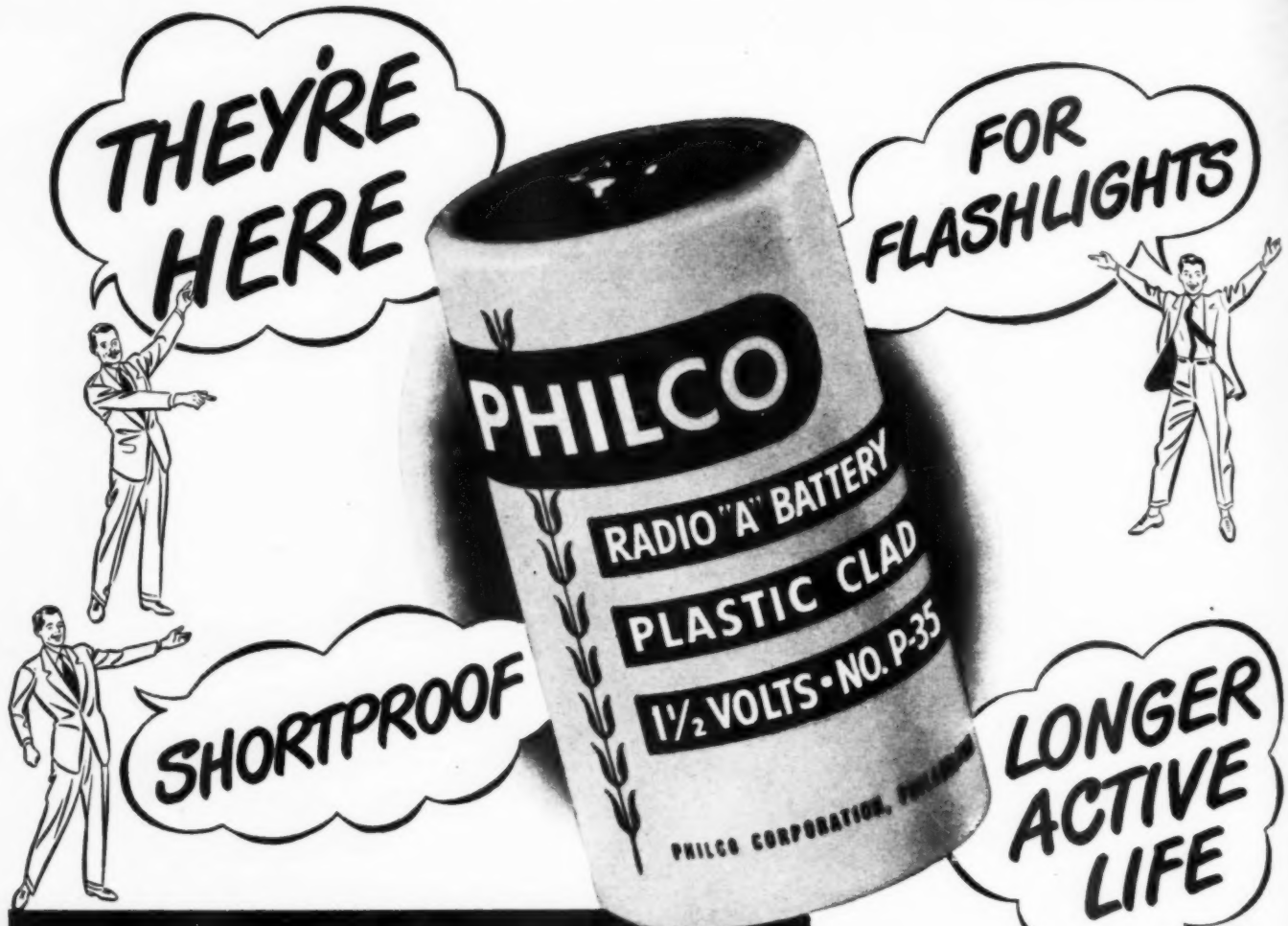
Mail your answers, and a reply will reach you soon afterwards, grading you on your knowledge of the subject. This is an organized, hard-hitting correspondence course. You'll work hard to learn—but the hours you devote to General Electric's TV-service course will pay off in the sale of tubes, parts, and service to owners with real money to spend.

See your G-E tube distributor for the details! He's ready *now* to start you along this thruway to profits. It's one more step in General Electric's 1949 campaign to help you help yourself to prosperity and an assured business future. *Electronics Department, General Electric Company, Schenectady 5, New York.*

You can put your confidence in—

GENERAL ELECTRIC

191-HA4



THE NEW *"Plastic Clad"*

PHILCO

RADIO "A"

BATTERIES

INCREASE THE LIFE OF YOUR FLASHLIGHT

Here, from Philco, is the flashlight battery customers will *cheer* for. It's shortproof . . . and packed with 20% more active material for extra long life that keeps buyers coming back for more.

NEW COUNTER DISPENSER

Turns stock fast! They sell on sight, in this compact eye catching dispenser. Place it up front and cash in on this big news in flashlight batteries. Has testing bulb. Fits in minimum space.

GET READY FOR THE NO. 3 PHILCO ACCESSORY "GOLD RUSH" PROMOTION

SEE YOUR PHILCO DISTRIBUTOR

Don Lee's New $3,000,000 STUDIOS

By
WALTER W. CARRUTHERS
Chief Eng., Studio Div.,
Don Lee Broadcasting System

The "Electronic Brain" is one of the many unique features of Mutual Don Lee network broadcasting headquarters in heart of Hollywood's radio center.

Shown above is Mutual Don Lee's new three-million-dollar broadcasting building. Insert shows one of the four radio-television studios. Each studio is painted in 19 colors, running through the spectrum from a lemon-yellow to a deep blue-green.

A NEW building has gone up in Hollywood. . . . the new home for the West Coast operations of the Mutual and Don Lee Broadcasting Systems, one of the most complete installations of its kind ever to be erected. The growth of Mutual and Don Lee required repeated expansion of the program production and studio facilities in use at the Hollywood headquarters. When the requirements became clear, however, it was decided to make a complete break with the past and design a new network center from the ground up, with new equipment designed specifically to provide the most efficient facilities for both existing and future needs. Description of the three-million-dollar, block-square building divides naturally into two parts: studio complement and acoustic design and program control equipment.

The studio designing program started in 1943 by Willet H. Brown, vice-president and general manager of the Don Lee Broadcasting System, and Walter W. Carruthers, called for four auditorium sound stages—each 115 feet by 65 feet—four spacious dramatic studios and six smaller commentary and announce booth type studios. Each was studied individually for a particular type of radio program and was built as a separate and completely isolated cement structure. Claude Beelman, architect, tied the eight individual buildings into one four-story structure with general and executive offices, lounges, dressing and conference rooms, and work areas for the many network departments.

In contemplating the design of the new Mutual Don Lee Broadcasting Studios, several problems had to be considered.

Since radio programs usually fall into three general categories—musical and variety, dramatic, and commentary and announcement—each had a specialized requirement which needed consideration in studio design. To use the space requirements of the musical studios as an example, a certain room size is demanded consistent with a certain type of music. Since we usually hear orchestras in halls bearing certain relationships in size to that of the orchestras, there is an emotional satisfaction when this effect is reproduced. The quality of the reverberation of a large room is successfully simulated at the present time only in rooms of commensurate size. Another way to think of this relationship is as "space effect," an audible perspective to the ear, as "depth" in a picture is perspective to the eye.

In order to facilitate picturing an actual orchestra, the direct sound must reach the ear surrounded by the indirect reflections or reverberation

character of the natural surroundings. Lack of this effect lessens our ability to mentally orient an orchestra with its component parts separated in space, resulting in an underestimation of the size of the orchestra and a diminished sense of the number of instruments playing each part.

Although the number of instruments may be increased in a studio of insufficient volume, the impression of added orchestral size is not proportional; however, where the number of instruments is small compared to the volume normally associated with the group, it is possible, with proper pickup, to create the effect of numbers in excess of those actually employed.

Much has been published on the problem of optimum reverberation characteristic for each type of studio. In order to correlate objective data with the subjective, or "sound," as interpreted by management, producer, artist, engineer, etc., first-hand information was required.

In the growing art of broadcasting, the optimum reverberation characteristic for a given room size has been controversial as with most things dealing with the aesthetic. Programs emanating from certain music halls and studios seemed to score a unanimity of opinion as to sound excellence. Equipment capable of producing tones and graphically recording the time of sound decay was moved into these favored places and the resulting curves were compared. There was an unmistakable similarity about all of them. An average of these measurements was taken as the optimum reverberation characteristic. The studio which had a sound characteristic closest to the selected standard was chosen as the place to produce a series of programs, so that a more careful study could be made in listening tests.

Aside from the quantitative aspect, other, more subtle, factors were considered, among them, the shape of each studio. To minimize sound and mechanical transmission, each studio was basically designed within an isolated 8 inch concrete enclosure dimensioned to a ratio of 2:3:5. To minimize standing modes, the inner walls of wooden construction were angled to avoid parallel surfaces. The ceiling was angled with respect to the floor. As a compromise between sound diffusion and the retention of room character, the walls and ceiling were alternately treated with different areas of convex and flat surfaces. For acoustic amplification, the auditorium stages were shaped to form a gigantic orchestra shell.

In the sound treatment calculation another acoustic factor considered was the use of wood. All areas not otherwise employed were used to expose wooden panels in an effort to gain tonal enrichment by sympathetic vibration. For producing aperiodic irregularities in the reverberation decay characteristic, the sound absorbent materials were randomly placed yet the architectural beauty and symmetry were preserved.

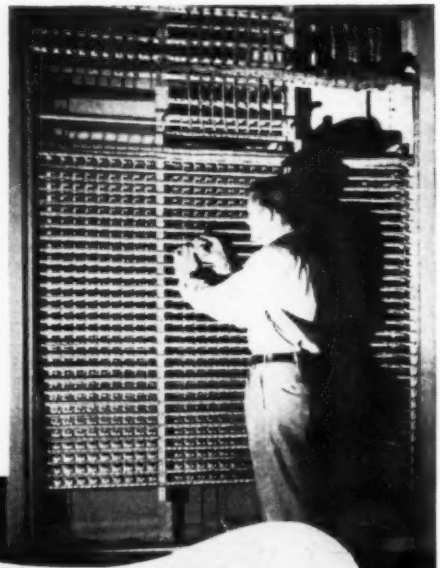
The next problem was to design an auditorium which would conform to the optimum sound characteristic. In earlier building history, such an undertaking would be difficult. Today, with the science of acoustical engineering, it is possible to calculate the sound treatment for a given volume enclosure so that the desired reverberation characteristic can be obtained. The audible spectrum was divided into three regions—high, middle, and low frequencies. Each group was studied separately and given a different type of treatment in an effort to gain the desired results.

Low-frequency reverberation is usually excessive in rooms because materials normally found there do not absorb the lower tones as rapidly as higher tones. Through use of diaphragmatic areas, control can be exercised in the dissipation of low frequency sound. A "polycylindrical diffuser" is a form which has been used as a low-frequency reverberation control element. It is constructed with a thin sheet of veneer wood bent over a convex form. The wood is at a tension and by virtue of the ribs which are spaced at random, many diaphragms are created which vibrate at different frequencies. The multiplicity effect in the vibrating diaphragms causes an evenness in the attenuation of the low frequency reverberation.

The absorption of middle frequency sound is controlled by the amount of exposed area of such common materials found in the auditorium as upholstered seats, carpeting, drapes and wall treatment. Each material has a different coefficient of absorption, and all surfaces in the room must be taken into account.

High frequencies are usually absorbed to a greater degree by the same material affecting the mid-band frequencies and to further exaggerate the condition, sound travel through the air acts as high frequency absorption. To help compensate for this natural attenuation the convex surface was painted with hard enamel so that while it was acting as a low frequency control it could be highly reflective in maintaining high frequency persistence.

In the Don Lee studios the construction schedule was so arranged that sound measurements could be made as each type of material was added. There was a two-fold purpose in this procedure: (1) The acoustic measure-

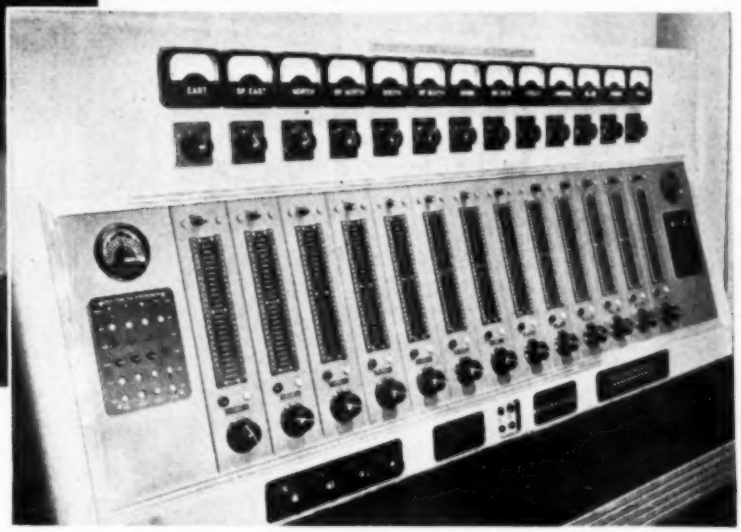


Engineer Doc Bennett works on the relays behind the master control unit. The board, which cost $300,000, is one of the largest control systems in the country.

Earl Grant (left, standing), Don Lee Engineer; D. P. Loye, Technical Construction Superintendent for Western Electric; J. Garafalo, Western Electric Engineer; and Walter Carruthers, Chief Engineer, Studio Division, Don Lee, make sound measurements during construction of one of the large auditoriums.

Custom-built speech input console. Mutual Don Lee's new Hollywood headquarters include four large auditorium studios, each 170,000 cubic feet in volume and seating 350 people. All of these four studios have Western Electric control consoles located in the control booths which are at left of the stages.

A close-up of the control panel shows the numerous meters and controls necessary to serve the eleven studios and five different network lines radiating from this network center.



ments gave a family of related curves, each of which allowed a check on predictions as calculated for that stage of the building program. If, at that time, curve measures were indicated, it was simple to make them while that part of the construction crew was still on the job. (2) From an academic point of view the calculation of the sound absorption coefficient of each type of construction and material was made possible which would greatly facilitate the building program in the future by virtue of such information being compiled and available. Fig. 1 shows a typical family of curves resulting from measurements made during the course of construction. Here, for the first time, a building was constructed to the optimum reverberation characteristic indicated by the curves as they approach the dotted line representing the optimum.

It has been the usual practice for network centers to expand facilities on an add-a-unit basis in which the new would supplant the old as it became obsolete. The new $3,000,000 Mutual Don Lee Broadcasting System plant is different in that with the move to the new quarters there was a complete break away from the old. There was very little, if any, transfer of equipment. Fortunately, the change had been anticipated for sufficient time to allow research and development with the exacting standards and demands imposed by modern AM, FM and television broadcasting.

In considering the studio control desk and master control room equipment, the engineering and developmental services of *Western Electric* were called upon to pose problems and needs and to share the vast experience and engineering background acquired through many years in the field of telephone communication.

The present master control equipment is the result of a vast amount of collective study over a period of years. In the early days of the network, the switching was done by patch cords in which the line from the originating studios was manually patched into the telephone lines. The "patch-up-bridging bus-system" of program distribution proved inadequate as it became common for a number of programs to stop and others to start at the same time, and there grew a need for a coordinating center in program switching. Relays were substituted for patch cords. A system of pre-set selection followed, allowing the operator to anticipate forthcoming programs rather than act under the pressure of time.

With the rapid advance in the D. L. B. S. network activities, the installation became overloaded and obsolete. In 1934 a master control switching panel was set up using *Western Electric* locking 92 type keys to activate the relays. One hundred and forty-four program switching possibilities were represented by 144 keys. There were twelve incoming and twelve outgoing lines.

In 1940 a move to the Melrose Ave. location gave rise to a larger and more complex master control system. The switching panel was expanded to a 17x20 board with 340 possible connections. For presetting, 92 type keys were replaced with rotary switches at the bottoms of the strips of green and red lights. Above each strip was located a volume indicator. It was then only necessary to rotate the switch until a green light stopped opposite the desired switch to be made. Then by push button a red light would be lit opposite the green showing the switch had been completed.

In 1948 a system was evolved which was a far cry from the early days of patch and cord switching. *Western Electric* engineers were invited to sur-

(*Continued on page* 156)

Over-all view of master control panel. Built by Western Electric, this master control incorporates a switching system for over 800 possible program combinations and requires 821 relays, 49 amplifiers, 850 indicator lamps, 2500 jacks and 13 volume indicators. This entire system can be controlled by only one man.

How To Eliminate AUTO RADIO STATIC

By
M. C. ANDERSON

Locate that baffling source of static noise by means of these to-the-point suggestions.

THERE is nothing mystifying about radio static to most amateurs, and the average radio fan, up against a static problem, would start a systematic check to eliminate the noise. Put the radio in an automobile, however, and we have to contend with the ignition and other units with which the radio man may not be familiar. Anyone can improve auto radio reception and eliminate annoying static noises by a few simple tests which require no special equipment whatsoever.

One way to eliminate noises, of course, is to remove the radio from the noise source, provided the cause is external. In autos, however, this is seldom possible, since mounting space is at a premium. The radio must generally be mounted right in the midst of a whole group of static-producing units. In spite of this, it is usually a comparatively simple matter to eliminate noise from the auto radio by checking it at its source.

Location. Though the choice of mounting locations for the auto radio is likely to be small, an attempt should be made to locate the radio as far from the ignition coil as possible. Generally speaking, a position at the extreme upper-right side of the dash is best for most installations; however, often some other location must be chosen because of interference with the heater or other equipment. In any case, make certain that the radio is well grounded to the dash through the mounting bolts by thoroughly cleaning the metal before tightening down the nuts.

Ignition system. The ignition system is commonly thought to be the worst static producer on the automobile, probably because of the high voltages used to jump the spark gap. Actually, if the ignition system is in good condition it may give much less static trouble than other often unsuspected parts, such as the tires.

Poor ground connections on cables and rods which pass through the firewall may be quickly located by shorting them to the wall.

If the motor does not run evenly or shows other signs of ignition system trouble, chances are that the system will be a noise-producer. In this case, the system should be thoroughly checked.

Ignition system noise, if present, is usually easy enough to distinguish from other static noises. Tracking down the source of the leak may not be so easy. Begin by checking and regapping the spark plugs to the manufacturer's specifications. Plugs which have worn over the specified gap clearance will be likely to cause radio noise. Noise suppressors may be mounted on top of the spark plugs if subsequent tests indicate that they are necessary. These should be mounted in a horizontal position, or parallel to the head of the engine, as shown, if possible. Make certain that the suppressors are not near any wires, fuel or oil lines, or the like, which might pick up radiation and carry it to the radio. A good test to run on these suppressors after installation is to check continuity from the distributor cap to the spark plug with a battery light. An open circuit will cause arcing and radio static.

While the distributor is open, check the condition of the breaker points. Burned or pitted points will cause radio noise and should be replaced rather than filed. Point clearance should also be checked and correctly set at this time, or you may have your local garage do the job for you on a distributor test machine. Check the condition of the distributor rotor and distributor cap contact points. They should be clean and bright. If the points are pitted or burned, replace the rotor or distributor cap, or both. The rotor point to distributor cap contact clearance is also important and must not be excessive, or the resultant arcing will be heard in the radio. A gap of over .005" is likely to cause trouble here, and should be decreased either by installing a new rotor, or building up the old one by adding solder to the end of the electrode. Take care, however, that the point is not lengthened enough to strike the cap electrodes causing breakage. A suppressor may be used at the center lead of the distributor also, and should be placed here in preference to the cable outlet at the ignition coil.

If all these check-points are carefully inspected and cared for, and the ignition noise still persists in the radio, it is likely that the static is being transmitted to the radio by parts outside the ignition system. The choice may be narrowed somewhat by disconnecting the antenna from the set. If the noise persists, it is being transmitted through the frame of the car, but if it subsides, it is being picked up from the antenna. If the trouble lies in the antenna, check the leadin for proper shielding and make certain that the lead-in shield is well grounded. No part of the antenna system itself must touch the car.

If the noise does not decrease when the antenna is dis-

connected, showing that it is being picked up from the chassis, check the ground connections on the radio, engine, and on all rods or lines passing through the dash. A file is a handy tool to use when checking grounds, since the teeth bite into the metal and give a good contact on painted or greasy surfaces. Check the speedometer cable, choke and throttle rods, oil lines, etc., by grounding them to the dash with the file. If the noise decreases, ground the offending part with a short length of copper braid well-soldered to both the rod and the dash of the car. Do this at the dash itself, using a length of braid just long enough to allow free movement of the control. Wires entirely outside of the ignition system sometimes pick up and transmit ignition noises. Check to see if any low-voltage wires (such as the generator leads) run through the same housing with the ignition wiring. If so, remove them and reroute the wires away from the ignition system. In extreme cases, it may be necessary to slide a flexible woven wire shielding over such wires to prevent radio interference. Check all wiring connections, such as those at the generator, ammeter, oil pressure gauge, etc., to make certain that they are tight. When making these tests, the radio should be tuned off-station for maximum sensitivity and the volume turned full on. Then, any variation in the noise level will be most apparent, since the static noise will be at its peak.

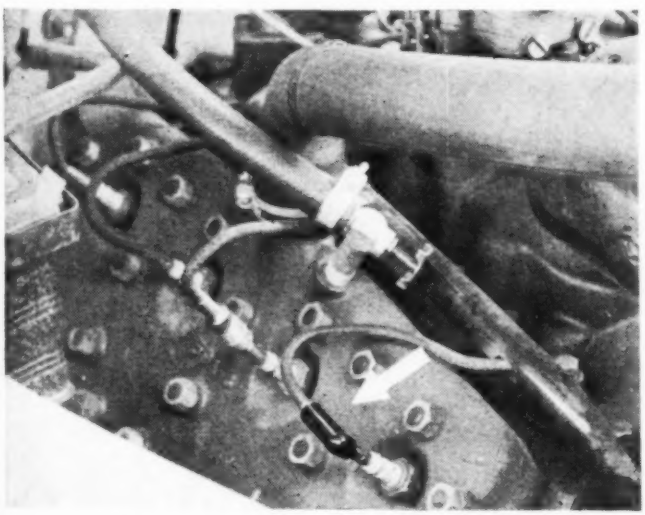
Generator. Generator noise may usually be eliminated by a condenser shunted across the cutout. Mount the condenser under one of the cutout mounting screws and attach the lead to the generator side of the cutout.

Clean the commutator with fine sandpaper and see that the brushes are making good contact. Brushes which have worn short will give poor contact due to low spring tension and should be replaced to prevent arcing and radio interference. Be sure to properly seat in the new brushes by running a strip of fine sandpaper about the commutator, rough side out, and drawing it back and forth to cut the brushes to the contour of the commutator.

In some cases, a second condenser may be necessary, connected across the generator armature terminal to a good ground on the generator housing.

Generator noise may be identified as a howl or whine in the receiver which will begin when the motor is speeded up sufficiently to operate the cutout and cause the ammeter to register charge. This may be further verified by speeding up the engine and then shutting it off. The noise, if it is being caused by the generator, will persist, dropping off as the generator loses speed and the engine finally comes to a stop.

Tires. Considerable trouble has been experienced with radio noise caused by static electricity generated by the tires, and especially so in the case of synthetic rubber tires. Tire noise is usually heard as an almost continuous roar in the radio. The noise will be heard only when the car is on the road and in motion, and the radio may work perfectly while the car is standing still, even with the engine running. (*Continued on page* 125)



← Spark plug noise suppressors are of two types. The kind that is mounted parallel to the engine head (arrow) reduces the chances of transferring the noise to other wiring points.

↑ (1) It's important to check on the distributor point clearance as well as the condition of the points themselves. (2) Spark plug gaps, if incorrect, can increase radio static noise. (3) If generator noise is heard in the radio, it may be necessary to seat in the brushes with sandpaper. (4) Distributor rotor to electrode clearance is important to good reception; watch for pitted contacts.

By adding this pre-amplifier to your present receiver, better reception is obtained from remote FM stations.

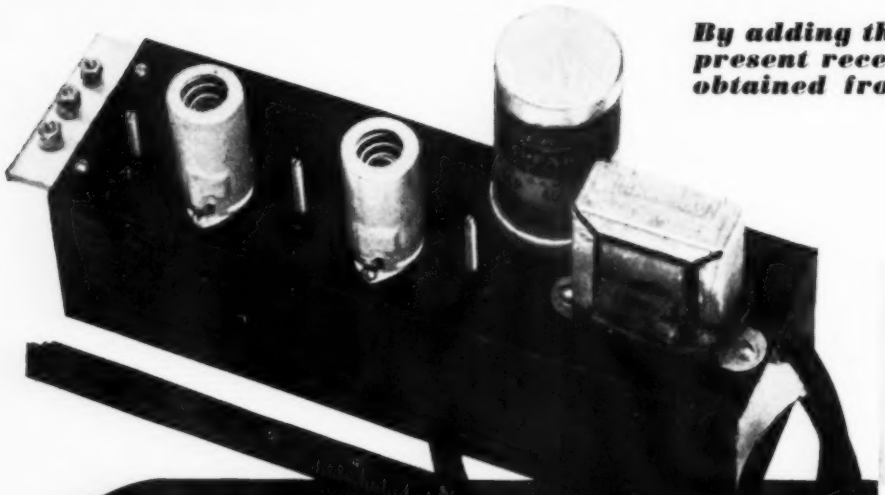


Fig. 1. Top view of the home-built pre-amplifier. Although designed specifically for the FM band, this booster, with modified coils, can be made to cover TV and the 10, 6, and 2- meter amateur bands.

A Booster For Your FM RECEIVER

By
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THE writer happens to be in a very poor location for FM reception. There are no local stations, and the antenna cannot be mounted on a high tower because of building restrictions. Measurement of the receiver sensitivity showed that it was not all that it might be. This unhappy situation led to a study of the limitations of receiver sensitivity, which resulted in the design of the preamplifier to be described.

At first glance it might appear that, in the absence of atmospheric or man-made noise, any number of amplifier stages might be added ahead of a receiver to increase its sensitivity. However, this is not so for two reasons. The first is that the amplifiers themselves contribute noise—*tube noise*. The second, and much more fundamental reason, is that the antenna itself contributes some noise as a result of thermal radiation from its surroundings. Since the objects around the antenna, including the earth and sun, are hot, they radiate heat. Some of this is picked up by the antenna, and appears as a random voltage at its terminals. It turns out that the magnitude of the voltage depends upon the resistance presented by the antenna. In fact, the antenna can be replaced by an equal resistance, and the same noise voltage will be obtained, provided the resistance is maintained at the same temperature as the objects around the antenna. It is this noise voltage, *Johnson Noise*, which places a limit on the amount of amplification that can be placed ahead of the receiver. Even if the amplifiers themselves were perfect, the receiver could be made to overload on Johnson noise alone with sufficient amplification.

Obviously, it is desirable to make the receiver as sensitive as possible. This involves, then, not only sufficient amplification, but also low-noise amplifiers. The noisiness of an amplifier is expressed in terms of "noise figure," which is the ratio of the total noise output of the amplifier to the output that would result from Johnson noise alone. A perfectly noise-free amplifier would then have a noise figure of 1. All amplifiers do contribute some noise, and consequently have noise figures greater than 1.

Tubes contain many sources of noise. The basic one, however, results from the fact that electrons are discrete charges of electricity. Therefore, every time an electron passes the grid, a small voltage is induced in it, which is amplified and heard as noise. Another source of noise is encountered in pentode tubes, or in any tube with positive grids which draw current. Since the current must divide between the positive grid and plate, this division takes place in a random manner. The result is, again, more noise. Other noise sources, such as gas and hum, are not important here because of the high frequencies involved.

Preamplifier

It appears, then, that a triode tube, which does not have a positive grid, is best for the preamplifier. Unfortunately, as is well known, neutralization is required. Although the triode could have been used as a grounded-grid amplifier without neutralization, it has been the writer's experience that a better noise figure can be obtained with the ordinary, neutralized connection. A fair amount of gain is required to override the receiver noise. Calculations showed that, in this case, two stages would be necessary for a band width of 15 megacycles, which is required to cover most of the FM band.

Figs. 1 and 3 are photographs of the preamplifier, which was constructed on a narrow chassis-base to permit placement inside an S-55 receiver. Fig. 2 is the schematic diagram showing two stages, with V_1 connected as a triode for low noise and V_2 connected as a pentode for high gain.

The coils, L_1, L_3, and L_4, are slug-tuned without any additional capacity, for maximum bandwidth. Loading resistors R_1, R_3, and R_6 are used to obtain still broader tuned circuits. The second stage, V_2, is a conventional pentode amplifier, with link coupling to the receiver. It will be noted in the parts list that all bypassing is done with button-type silver-mica condensers. Although these condensers are fairly expensive (even on surplus) it was felt that they should be used because they permit very low-inductance connections. It is possible that small, tubular ceramicons might be substituted with only a small sacrifice in performance.

The first stage, V_1, has the screen-grid and plate tied together to obtain a triode connection. As mentioned above, neutralization is necessary, which is accomplished by means of L_2. This coil "tunes-out" the grid-to-plate capacity, resulting in a high imped-

ance, which prevents feedback and oscillation. The antenna is link-coupled, the number of turns having been adjusted for optimum noise figure with a 300-ohm feeder. A center-tap is brought out so that the FM antenna can also be used on the broadcast-band without affecting its FM performance.

The power supply is novel in that two filament transformers are used "back to back" to obtain the required voltages. Filament transformer T_1, which is connected to the a.c. line, provides heater voltage for the tubes, and drives T_2, which gives about 90 volts a.c. for the rectifier plate supply. In this way, it was possible to use two very compact transformers and a single selenium rectifier. The preamplifier could be operated with an a.c.-d.c. power supply, eliminating the transformers, but it was considered undesirable in this case. It is possible that the receiver itself could supply the power, since the requirement is only 6.3 volts at 0.35 amperes and 75 volts at 20 milliamperes.

Construction

Figs. 1 and 3 show the parts layout used. This should be closely followed for best results. It is necessary that the three coils, L_1, L_2, and L_4, be mounted at one side of the chassis-base rather than in the center, to decrease the coupling between them. The selenium rectifier can be mounted under the chassis-base because the heat dissipated is very small with a current of only 20 milliamperes.

When wiring, C_1 and C_2 should be returned to *one* of the screws mounting the socket of V_1. C_5 should be returned to the other screw on the same socket. In the same manner, C_4 and C_3 should be returned to one of the screws mounting the socket of V_2.

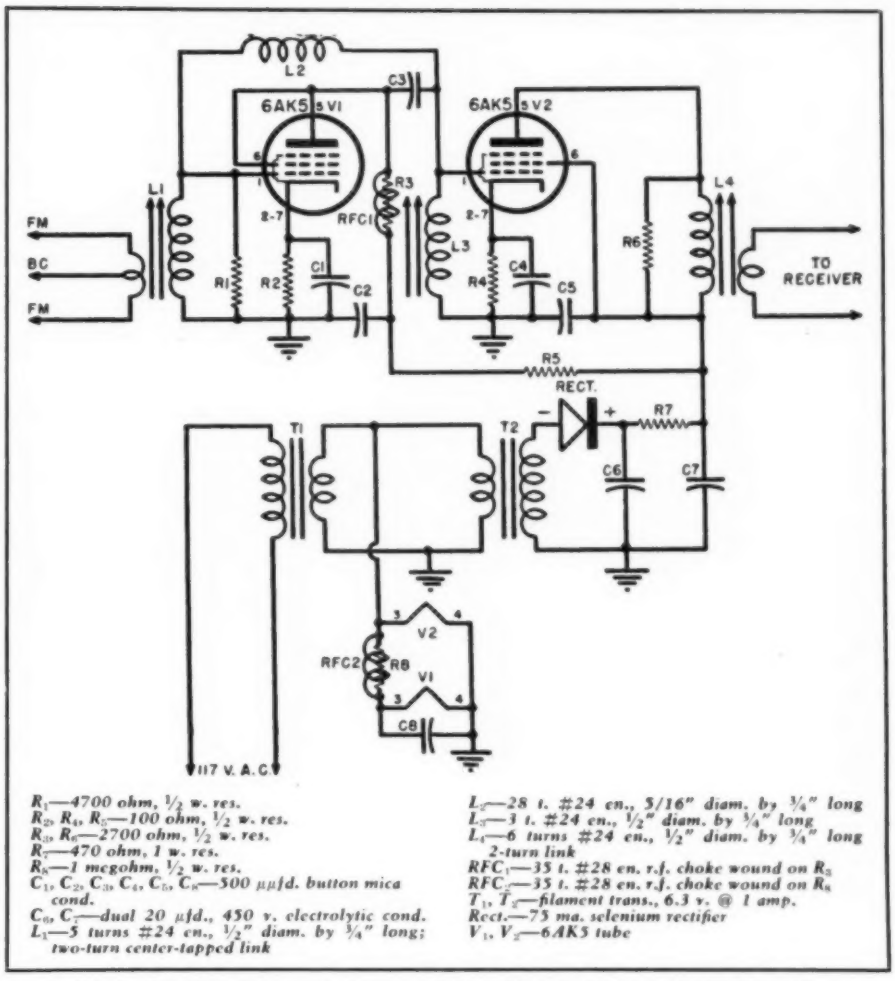
The tuning coils L_1, L_2, and L_4 were wound on surplus slug-tuned forms. If these are not available, *National* XR-50 forms will do very well. When mounting L_2, the neutralizing coil, it should be placed at right-angles to L_1 and L_3.

Adjustment

After the wiring is finished, the grid of V_1 should be grounded to prevent oscillation, and the power should be turned on. The plate supply should be approximately 75 volts, while the drops across R_2 and R_4 should be about 1 volt, indicating cathode currents of 10 milliamperes in each tube.

If everything is satisfactory, the link of L_4 can be connected to the receiver through a short piece of twisted-pair. If long leads are necessary, 300-ohm twin-lead should be used. With the receiver set at 100 megacycles, a very noticeable peak should occur in the noise as L_4 is tuned through its range. Both L_3 and L_4 should be set for maximum noise output at the middle of the FM band.

It is next necessary to neutralize V_1. This can be accomplished by ungrounding the grid, and disconnecting R_3 at the connection C_2-R_3. If a signal generator is available, it should be



R_1—4700 ohm, ½ w. res.
R_2, R_4, R_5—100 ohm, ½ w. res.
R_3, R_6—2700 ohm, ½ w. res.
R_7—470 ohm, 1 w. res.
R_8—1 megohm, ½ w. res.
C_1, C_2, C_3, C_4, C_5, C_8—500 μμfd. button mica cond.
C_6, C_7—dual 20 μfd., 450 v. electrolytic cond.
L_1—5 turns #24 en., ½" diam. by ¾" long; two-turn center-tapped link
L_2—28 t. #24 en., 5/16" diam. by ¾" long
L_3—3 t. #24 en., ½" diam. by ¾" long
L_4—6 turns #24 en., ½" diam. by ¾" long 2-turn link
RFC_1—35 t. #28 en. r.f. choke wound on R_3
RFC_2—35 t. #28 en. r.f. choke wound on R_8
T_1, T_2—filament trans., 6.3 v. @ 1 amp.
Rect.—75 ma. selenium rectifier
V_1, V_2—6AK5 tube

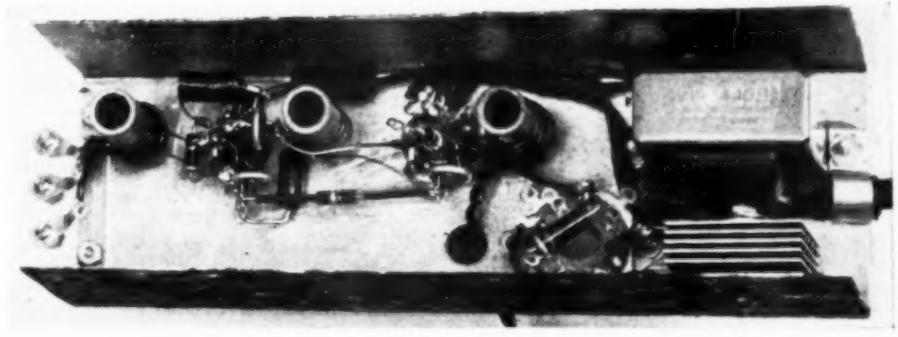
Fig. 2. Complete schematic diagram of the self-contained two-tube FM booster.

connected to the antenna terminals and tuned to the receiver frequency. If not, the antenna should be connected, and a strong station near the center of the band tuned in. It is necessary to vary the inductance of L_2 to check for neutralization. This can best be accomplished by means of a tuning stick, which has a copper slug on one end and a piece of powdered iron on the other. As one end or the other of the tuning stick is inserted in L_2, a sudden dip will be noted in the receiver output. The dip is the desired condition, since there is then no coupling from grid to plate, or vice-versa. If it is necessary to insert the copper slug to obtain a dip, the inductance is too high, and the coil should be spread out, or should have turns removed. The reverse applies, of course, if the iron slug produces a dip. When the proper adjustment is obtained, a dip will be obtained without the insertion of either slug, and inserting either slug will make the signal stronger. At this point the coil should be coated with coil dope.

The antenna can then be connected, and plate voltage can be restored to V_1 by reconnecting R_3. L_1 should then be tuned for maximum noise at the band center. The FM receiver can then be tuned through the entire band. There should be no sharp peaks of noise at any one frequency, since these would indicate regeneration or oscillation. If there are, the adjustment of L_2 can be checked.

(*Continued on page* 131)

Fig. 3. Under-chassis view of pre-amplifier shows relative placement of components.



A Novel Plate-Dip OSCILLATOR

By E. J. SCHULTZ, W2MUU

Plate dip oscillator being used to adjust a two-meter converter to frequency before the power is applied.

This instrument can be used to measure resonant frequency of circuits, as a signal generator, and as a field strength meter, harmonic checker, etc.

MOST amateurs and experimenters are familiar with the versatile instrument known as the grid dip meter. In short, a grid dip meter is an oscillator with a meter connected in its grid return indicating oscillator grid current. The current is relative to the strength of oscillation and if the oscillator circuit is loaded, the meter will register a decrease proportionate to the load. The meter, therefore, can indicate the resonant frequency of a tuned circuit by coupling the oscillator to the circuit in question and varying the frequency of the grid dip meter until a pronounced dip occurs. Conversely a trap or other tuned tank to be adjusted to a given frequency can be set by leaving the instrument frequency constant and tuning the unknown circuit to resonance as indicated by the grid dip.

The instrument herein described performs in essentially the same manner, with the exception that the dipping meter is placed in the plate circuit instead of the grid. In the conventional oscillator circuit normally employed in instruments of this type, the plate current increases with load and the change is relatively small as compared with the grid. However, the oscillator diagrammed in Fig. 1 is unconventional to say the least, the plate current vastly *decreasing* with small loading. Using a 6J6 twin triode, the oscillator is the negative resistance type of excellent stability. It is a warborn device which, in circuitry, is similar to a multivibrator. The particular circuit was chosen as it eliminates the need for coils with feedback windings and taps or a clumsy split-stator condenser as used in a Colpitts oscillator. Furthermore, the oscillator output is nearly constant over its useful range, only falling off slightly at the low frequency end of the highest band. Continuous coverage from 3 to 160 megacycles is obtained in 7 ranges with useful bandspread as each range covers slightly less than 2 to 1. Seven plug-in coils are used to change frequency. A reduction in the amount necessary for coverage of the range could be achieved by employing a larger tuning condenser with an attendant loss in bandspread.

The instrument was built in two parts, the oscillator and its components in one box and a power supply and compartment for the coils in the other. It was considered desirable to connect the units together with a cable from the oscillator terminated in a terminal strip on the power supply, as it might be necessary to operate from battery power in the field.

The oscillator is built around a *Hammarlund* Mc-50-S condenser, the tube socket being mounted on a bracket on the rear of the condenser for short connections. Any similar condenser may be used, but the double bearing type is preferable and straightline frequency construction, while not essential, is highly desirable for uniform dial calibration.

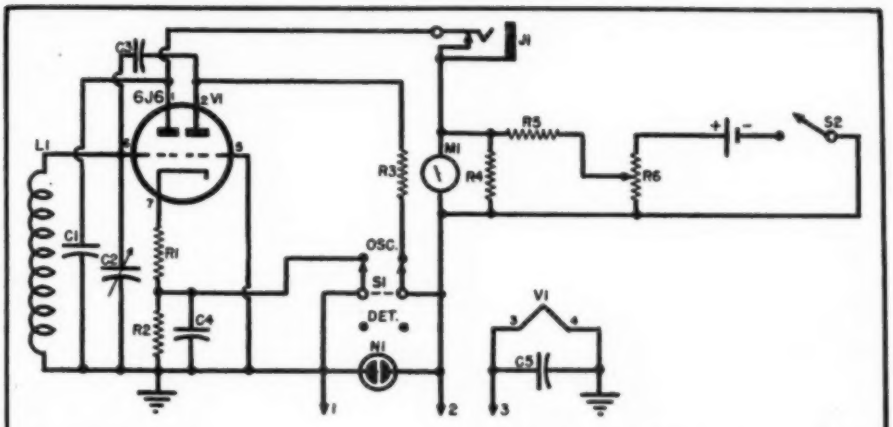
The ¾" poly coil forms employed were mounted on strips of polystyrene provided with pins from discarded octal tubes, spaced ½", so as to plug into a crystal socket. If the regular miniature coil forms with prongs are available, they are to be preferred, as they eliminate the need for making the previously mentioned polystyrene strip plugs.

A double-pole switch, labeled "det.-osc." in the schematic, removes plate voltage from one of the triodes and simultaneously increases the cathode bias, making the input triode a plate detector. The plate detector is a much more sensitive device than a diode as is provided by the usual grid dip meter in a non-oscillating condition, and the instrument can be used as a tuned vacuum tube voltmeter because the plate current will increase sharply when the instrument is loosely coupled to an r.f. source and tuned to resonance. A jack is provided for earphones (any type except crystal earphones may be used) and the instrument serves as a phone monitor in the detector position of the switch and as a c.w. monitor with the switch set to oscillate. A dry cell is connected across the meter and, in conjunction with a potentiometer, provides a variable bucking voltage to enable zero or full scale adjustment without varying the

instrument's sensitivity which would occur if a variable shunt across the meter was used. In "osc." position the potentiometer is adjusted to give full scale reading, resonance of an external circuit is indicated by a dip. When used as a detector the meter is set to zero and the current increases when the instrument is resonated with an r.f. source. The potentiometer is equipped with a switch to remove the bucking voltage from the meter when the instrument is not in use. The one-mil. meter employed in the model proved inadequate as the dip obtained when a resonant circuit was approached drove the meter off-scale in a negative direction. A shunt was therefore employed to slightly desensitize the instrument. If a 2- or 3-mil. meter is used, the shunt will not be necessary. An NE-51 neon bulb mounted on the oscillator serves the dual function of a pilot light and a voltage regulator maintaining the voltage fairly constant at about 105 volts.

These tubes vary widely, however, in their operating voltage, and it might be better to use a VR-150 in its stead. The filament transformer is used in the conventional way, while the output transformer is connected backwards. The secondary tap, giving sufficient output voltage across the primary to cause the neon tube to ignite, is selected by experiment. Very probably the proper tap will be the 4, the 8, or the 15.

The primary of the output transformer connected between ground and a selenium rectifier with an *R-C* filter completes the power supply. The two boxes housing the oscillator and the power supply are identical with the exception that a piece of polystyrene was used on the end of the oscillator housing instead of aluminum and one side of the power supply was cut and fitted with miniature 10 cent hinges, forming a door, and providing access to the coil compartment. The boxes measuring 3" x 4" x 5½" were both made from 3/64 aluminum and were bent without the aid of a brake by using pieces of angle iron in a vise. Commercially available metal boxes can, of course, be used, but the ones available hereabouts are not wide enough to take a 2" meter on the side.



R_1—390 ohm, ½ w. res.
R_2—1500 ohm, ½ w. res.
R_3—27,000 ohm, ½ w. res.
R_4—39 ohm, ½ w. res
R_5—100 ohm, ½ w. res.
R_6—300 ohm pot.
C_1, C_3—500 μμfd. mica cond.
C_2—50 μμfd. var. air cond. (see text)
C_4—10 μμfd. mica cond.
C_5—5000 μμfd. ceramic cond.
J_1—Closed circuit jack
S_1—D.p.d.t. slide sw.
S_2—S.p.s.t. sw.
M_1—1 ma. d.c. meter
N_1—NE-51 neon lamp

L_1—3-3 mc.—70 t. #30 en. closewound; 3-9 mc.—39 t. #28 d.s.b. closewound; 9-16 mc. —18 t. #28 d.s.b. closewound; 16-29.7 mc. —10 t. #26 d.s.b. closewound for 6 t. at bottom, remainder covers ¾"; 29-52 mc.— 5 t. #26 d.s.b. closewound for 3 t. at bottom, remainder covers ¾"; 50-89 mc.—3 t. #26 d.s.b. spaced to occupy ⅞"; 88-165 mc. 1/16" brass, 7/16" wide, bent to horseshoe shape, ½" radius, 1" long. All coils, except that for 88-165 mc., are wound on ¾" polystyrene forms 1½" long. Windings start ¼" from bottom end.
1—Penlight battery

Fig. 1. Circuit diagram of the novel plate dip oscillator unit.

However, by using one of the new miniature 1" meters or by changing the layout, they could, no doubt, be employed.

The dial pointer is made of a piece of 1/16" Plexiglas screwed to a conventional bakelite finger grip knob drilled and tapped for the purpose. The dial is made of a small piece of double-weight Bristol board purchased from the local art supply shop. It has a semi-gloss surface and readily accepts ink without preparation or blotting. Calibration was made by drilling small, evenly-spaced holes in the pointer and inserting a needle through the holes at appropriate points on the dial scale, later inking the points in. The dial scale is fastened to the instrument with rubber cement or Duco.

Calibration can be made, of course, using a number of methods, the method selected depending upon the equipment available and accuracy required by the individual's requirements. Calibration adequate for general purposes can be made using communications receivers for the low ranges and absorption meters or Lecher wires on the high bands. The instrument's accuracy is dependent on the accuracy of the calibration source and the care of the calibrator. For greatest accuracy

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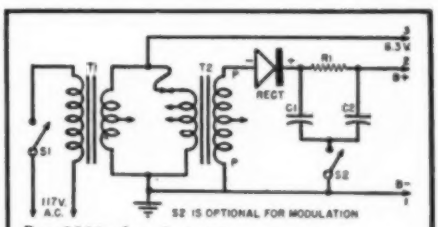
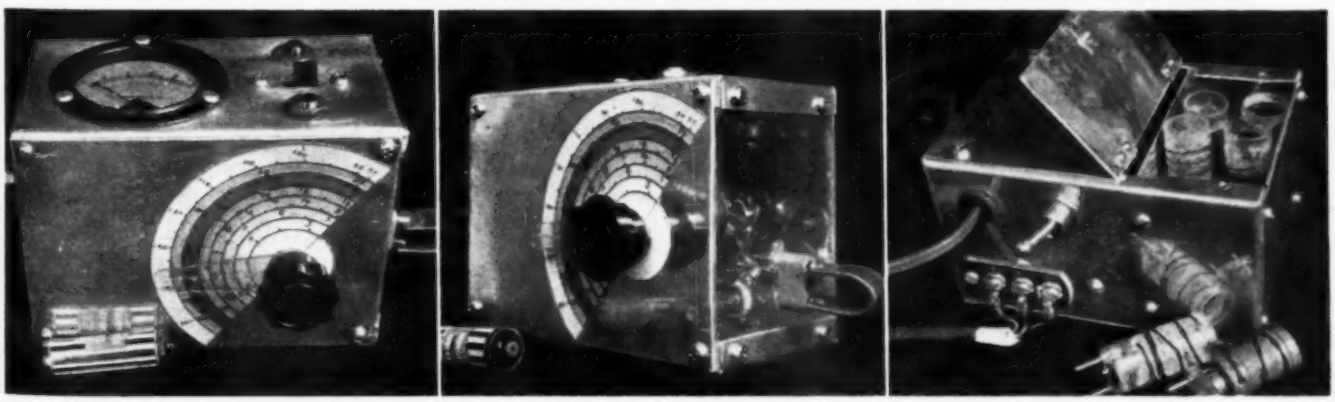


R_1—2500 ohm, 1 w. res.
C_1, C_2—20/20 μfd., 250 v. elec. cond.
S_1, S_2—S.p.s.t. toggle sw.
T_1—Fil. trans. 6.3 v. @ 1.2 amps.
T_2—Output trans., p.p. plates 5000 ohms to universal sec. (4, 8, 15, 250 and 500 ohms) (Stancor #A3800)
1—75 ma. selenium rectifier

Fig. 2. Circuit diagram of power supply used in conjunction with plate dip oscillator. The center taps on the secondaries of both transformers are not used.

(Left) Side view of instrument showing dial detail, layout of meter, switch, neon bulb, and jack. The penlight cell indicates comparative size. (Center) End view showing polystyrene endpiece. (Right) Over-all view of power supply unit. A separate coil compartment, shown with the door open, is incorporated. A three-wire cable supplies power to the instrument.



The BEGINNING AMATEUR

The receiving test. Here is where you worry a bit. Confidentially, this "ham" got through all right and is now operating as W1RWV.

By
ROBERT HERTZBERG, W2DJJ

Part 4. The FCC tests for ham licenses are like any other exam. They're easy—if you're prepared.

THREE tall young men, wearing the white-and-blue sweaters of a large Brooklyn high school, hovered in front of a door marked *Federal Communications Commission —Radio Operator Examinations* in a building at 641 Washington Street, New York. They were whispering to themselves and quite evidently were undecided about going in.

"Gee, I don't think I'm up to it, now that we're here," said one of them, as he eyed the door nervously.

"We came this far," said another, "so let's make a stab at it. What can we lose?"

The three brushed their hair back with quick waves of their hands and piled through the door as one. You'd think they were being called on the carpet to answer for some serious infraction of school rules, instead of merely making an entirely voluntary trip for the purpose of obtaining radio amateur operator and station licenses . . . "ham tickets." Behind the fateful door they found a large room, with a couple of desks in the center. Still fidgety, they approached and in unison mumbled something that sounded remotely like, "We'd like to take the ham license test."

The FCC engineer smiled at them in a most friendly manner and said, "Sure, boys. I'll give you the application forms to fill out."

As he turned around to a filing cabinet he whispered to me, "Scared stiff, aren't they? No reason for it, either; we're here to help 'em."

Turning again to the three he continued, "Now, boys, just make yourselves comfortable at one of those tables and fill out these forms carefully. Relax and take your time. If you have any questions, just ask me."

Breathing more easily, the three young men took the forms to a table, sat down, unbuttoned their sweaters, and began to regain some of the color in their cheeks. Still whispering, one of them remarked to no one in particular,

"Hey, that guy's all right."

The FCC Form 610 they were given was headed *Application for Amateur Operator and/or Station License*. Each applicant filled in his pedigree: name, address, place and date of birth, etc., and repeated some of the information on a separate little card. The whole operation took five minutes. They carried the forms back to the FCC man, who examined them quickly with a practiced eye.

"These look OK," he said. "The first part of the exam is the code receiving test." He hesitated a moment as he saw the boys going pale again. "How about taking a dry run, boys? Just listen for a few minutes to get an idea as to how the stuff sounds."

Grateful beyond expression, the applicants followed the examiner into an adjacent room that had a familiar air to it. It was fitted with about two dozen of those little wooden desks found in schools everywhere. On each was a pair of earphones, a key and an inkwell and pen. The boys put on the phones and listened intently as precise, machine-made dots and dashes filled their ears.

At the automatic tape transmitter used for the code tests, the FCC engineer adjusted the speed control knob a bit.

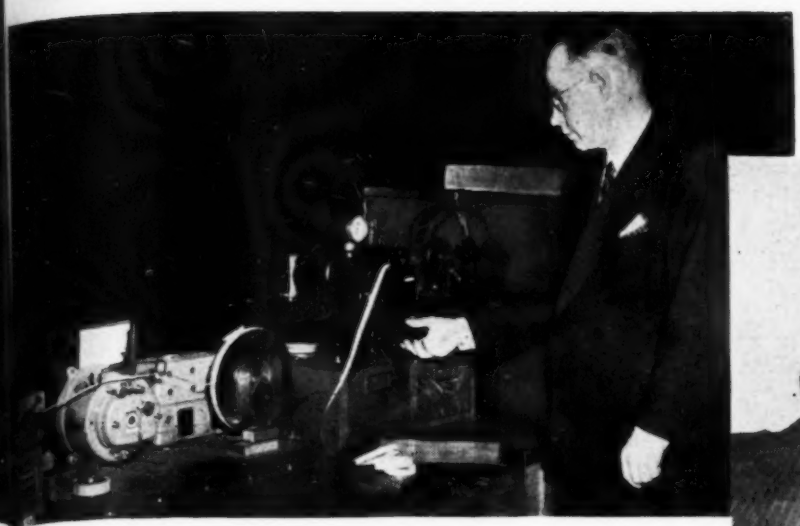
"The prescribed speed for the test is thirteen words per minute, plain text," he said to me. "The 'plain text' consists of understandable words, but the whole transmission doesn't necessarily make sense as a series of words and sentences. Numbers and 'Q' signals are thrown in at random, and the applicant must copy what he hears. Wait a minute; I'll get those boys started."

He went back into the examination room, handed each young man a couple of sheets of blank paper and said, "The next run will be for the record. Write clearly. The tape will be on for five minutes. If you copy any one minute's section without error, you pass. Take it easy. Good luck."

With a reassuring smile he returned to the tape machine and flipped it on. Their noses almost touching the paper, the boys wiggled their pencils furiously as the transmission got under way.

"This is the most important part of the test," continued the FCC man. "If an applicant flunks at this point, he's through. He can come back after thirty days and try again. How many times can he try? As often as he wants, just so he waits thirty days in between. We've had a couple of people who made six attempts before they passed, but that's unusual.

"My best suggestion for prospective hams is that they practice thoroughly and become proficient at fifteen words per minute or more before they attempt the exam. Too many of 'em rush right down after they hit thirteen. Surroundings here are different than at home, and almost everyone suffers from a little 'buck fever'. Another thing: our thirteen words per



←FCC Engineer Walter J. Howell adjusts the speed of the automatic code transmitter in the examining room of the FCC. Like so many other FCC men, Walter himself is a ham, holding the call W2II. He is a real old-timer, having obtained his license back in 1913.

Sending may seem a little better than receiving to the→ applicant. Here a potential licensee attempts to prove he knows his code, while FCC examiner Charles Finkleman, standing, lends a critical ear to the neophyte's dots and dashes.

←Your receiving test is checked, while you stand by nervously. If your code, receiving and sending tests have been found to be okay, the next step is a written examination.

↓ The examination room. Here a group of applicants takes the written test, which lasts from an hour to an hour and a half. Then you await results!

minute rate is really thirteen words per minute; no more, no less. When an applicant remarks that the test sounded too fast we just laugh."

At the end of the five-minute run, the FCC examiner immediately took the papers from the young men, before they had a chance to go over their "copy." He checked the results and in a few minutes announced that they had all passed.

"Now let me hear you send," he said. The group returned to the exam room, and the examiner listened with a pair of phones as each boy transmitted a sentence or two. "All OK, all OK. Now you get the written part. I'll give each of you a packet. Read the instructions on the envelope and go to work. You can take all afternoon if you want."

The packet contained five double pages of questions of the multiple-choice type. About thirty are devoted to technical topics and the rest to the rules and regulations. Several of them require the applicant to draw schematic diagrams. Most of the questions are pretty easy for anyone who has read any of the standard ham license manuals. A typical question might read like this:

The unit of resistance is the

1. *Volt*
2. *Ohm*
3. *Cycle*
4. *Centimeter*
5. *Ampere.* *Answer:*———

For the answer, the applicant merely writes in the appropriate number.

"Many people concentrate on learning the receiver and forget that they have to know how to transmit too," said the FCC man as the boys busied themselves with their papers. "We get quite a lot of applicants who sail right through the receiving part and then flunk out on sending."

The rest of the license procedure is simple. After the would-be ham finishes his written test, it is collected by the examiner, who, oddly enough,

(*Continued on page* 108)

DIRECTORY OF TELEVISION RECEIVER MANUFACTURERS

Admiral Corporation
3800 W. Cortland St.
Chicago 47, Ill.

Airadio, Inc.
Melrose Ave. & Barry Pl.
Stamford, Conn.

Air King Products Co., Inc.
170 53rd St.
Brooklyn 32, N. Y.

Andrea Radio Corp.
27-01 Bridge Plaza N.
Long Island City 1, N. Y.

Ansley Radio & Television, Inc.
41 St. Joes Ave.
Trenton, N. J.

Approved Electronic Instrument Corp.
142 Liberty St.
New York 6, N. Y.

Arcturus Radio & Television Corp.
19 Nesbitt St.
Newark, N. J.

Atlas Coil Winder, Inc.
392 State St.
Stamford, Conn.

Atlas Radio & Television, Inc.
26 Journal Square
Jersey City 6, N. J.

Audar, Inc.
Walnut & Maple Sts.
Argos, Ind.

Automatic Radio Mfg. Co.
122 Brookline Ave.
Boston 15, Mass.

Bace Television Corp.
Green & Leuning Sts.
S. Hackensack, N. J.

Bell Radio Co.
125 E. 46th St.
New York 17, N. Y.

Bell Television, Inc.
147 West 42nd St.
New York 18, N. Y.

Belmont Radio Corp.
5921 W. Dickens Ave.
Chicago 39, Ill.

Bendix Radio
Division of Bendix Aviation Corp.
Baltimore 4, Md.

Bowen & Co., Inc.
4712 Bethesda Ave.
Bethesda, Md.

Bowers Radio & Television Co.
44 S. 6th St.
Reading, Pa.

Brite-Ray Television Co.
7 Clinton St.
Brooklyn, N. Y.

Brunswick Radio & Television, Div. Radio & Television, Inc.
244 Madison Ave.
New York 16, N. Y.

Cage Projects, Inc.
393 Grove St.
Upper Montclair, N. J.

Certified Television Laboratories
5507 13th Ave.
Brooklyn 19, N. Y.

Cleervue Television Corp.
81 Willoughby St.
Brooklyn 1, N. Y.

Colonial Radio Corp.
254 Rano St.
Buffalo 7, N. Y.

Colonial Television Corp.
780 E. 137th St.
Bronx 54, N. Y.

Columbia Radio & Television Co.
85 Tompkins St.
Staten Island 4, N. Y.

Columbia Television Co.
601 E. Tremont Ave.
New York 57, N. Y.

Cornell Television, Inc.
385 Flatbush Ave., Ext.
Brooklyn 1, N. Y.

Coronet Radio & Television Corp.
500 W. 52nd St.
New York 19, N. Y.

Cortley Television Co.
15 W. 27th St.
New York 1, N. Y.

Cosmo Electronics Corp.
675 Hudson St.
New York 14, N. Y.

Crosley Div., AVCO Mfg. Corp.
1329 Arlington St.
Cincinnati 25, Ohio

DeWald Radio Mfg. Corp.
35-15 37th Ave.
Long Island City, N. Y.

Du Mont Laboratories Inc., Allen B.
2 Main Ave. 515 Madison Ave.
Passaic, N. J. New York, N. Y.

Duval Radio & Television Corp.
423 Grove St.
Jersey City 2, N. J.

Electronic Creations Co., Inc.
367 Greenwich St.
New York 13, N. Y.

Electro Technical Industries
1432 N. Broad St.
Philadelphia 21, Pa.

Emerson Radio & Phonograph Corp.
111 Eighth Ave.
New York 11, N. Y.

Espey Mfg. Co.
528 E. 72nd St.
New York 21, N. Y.

Fada Radio & Electric Co.
525 Main St.
Belleville, N. J.

Farnsworth Television & Radio Corp.
3700 S. Pontiac St.
Fort Wayne 1, Ind.

Federal Telephone & Radio Corp.
100 Kingsland Rd.
Clifton, N. J.

Federal Television Corp.
210 E. 9th St.
New York 3, N. Y.

Fisher Radio Corp.
41 E. 47th St.
New York 17, N. Y.

Fiske Products, Inc.
12 Maple Ave.
Mt. Kisco, N. Y.

Freed Radio Corp.
200 Hudson St.
New York 13, N. Y.

Garod Electronics Corp.
70 Washington St.
Brooklyn 1, N. Y.

General Electric Co.
Electronics Park
Syracuse 1, N. Y.

Gilfillan Bros., Inc.
1815 Venice Blvd.
Los Angeles 6, California

Globe Electronics, Inc.
225 W. 17th St.
New York 11, N. Y.

Gott Radio Mfg. Co.
6517 West Blvd.
Inglewood, Calif.

The Hallicrafters Co.
4401 W. 5th Ave.
Chicago 24, Ill.

Hoffman Radio Corp.
3761 S. Hill St.
Los Angeles 7, Calif.

Hollywood Electronics
7460 Melrose Ave.
Los Angeles, Calif.

Howard Radio Co.
1735 Belmont Ave.
Chicago 13, Ill.

Industrial Television, Inc.
359 Lexington Ave.
Clifton, N. J.

International Television Corp.
745 5th Ave.
New York 22, N. Y.

Jamaica Radio Television Mfg. Co.
148-18 Jamaica Ave.
Jamaica 2, N. Y.

Jewel Radio Corp.
583 Ave. of Americas
New York 11, N. Y.

Kinsey Radio Mfg. Co.
5807 Oak St.
Omaha 6, Nebr.

LaMagna Mfg. Co., Inc.
51 Clinton Pl.
E. Rutherford, N. J.

Lytle & Canon
4721 N. Kedzie
Chicago 25, Ill.

Magnavision Co.
3605 Kingsbridge Ave.
Bronx 63, N. Y.

Magnavision, Inc.
1546 2nd Ave.
New York 28, N. Y.

The Magnavox Co.
2131 Beuter Road
Fort Wayne 4, Ind.

Maguire Industries, Inc.
936 N. Michigan Ave.
Chicago 11, Ill.

Majestic Radio & Television Corp.
900 N. State St.
Elgin, Ill.

Major Television Co.
2500 David Stott Building
Detroit 26, Michigan

Mars Television, Inc.
29-05 40th Road
Long Island City 1, N. Y.

Midwest Radio & Television Corp.
909 Broadway
Cincinnati 2, Ohio

Motorola, Inc.
4545 Augusta Blvd.
Chicago 51, Ill.

MP Concert Installations
Fairfield 10, Conn.

Multiple Television Mfg. Co.
987 Hegeman Ave.
Brooklyn 8, N. Y.

Nalpak Products, Inc.
352 E. 32nd St.
New York 16, N. Y.

National Co., Inc.
61 Sherman St.
Malden 48, Mass.

National Polytronics, Inc.
2430 Atlantic Ave.
Brooklyn, N. Y.

New England Television Co.
544 E. 6th St.
New York 9, N. Y.

Nielsen Television Corp.
Newtown Ave. at Crawford Rd.
Norwalk, Conn.

Nobell Mfg. Co.
517 W. 47th St.
New York 19, N. Y.

Noblitt-Sparks Industries, Inc.
Columbus, Indiana

North American Philips Co., Inc.
100 E. 42nd St.
New York 17, N. Y.

Olympic Radio & Television, Inc.
3401-19 38th Ave.
Long Island City, New York

Orthon Corp.
196 Albion Ave.
Paterson 2, N. J.

Packard-Bell Co.
3443 Wilshire Blvd.
Los Angeles 5, Calif.

Philco Corp.
Tioga & C Sts.
Philadelphia 34, Pa.

Philharmonic Radio Corp.
119 W. 57th St.
New York 19, N. Y.

Pilot Radio Corp.
37-06 36th St.
Long Island City 1, N. Y.

Pioneer Television Co., Inc.
282 W. 25th St.
New York 1, N. Y.

Radio Corp. of America
RCA Victor Div.
Camden, N. J.

Radio Craftsmen, Inc.
1341 S. Michigan Blvd.
Chicago, Ill.

Regal Electronics Corp.
603 W. 130 St.
New York 27, N. Y.

Remington Radio Corp.
80 Main St.
White Plains, N. Y.

Remler Co., Ltd.
2101 Bryant St.
San Francisco 10, Calif.

RGH Mfg. Corp.
365 Canal St.
New York 13, N. Y.

Royal Television & Radio Corp.
81 Willoughby St.
Brooklyn, N. Y.

Scott Radio Laboratories
4541 Ravenswood Ave.
Chicago 40, Illinois

Sentinel Radio Corp.
2100 Dempster St.
Evanston, Ill.

Shevers, Inc., Harold
33 West 46th St.
New York 19, N. Y.

Sightmaster Corp.
385 North Ave. 220 5th Ave.
New Rochelle, N. Y. New York 1, N. Y.

Slate & Co.
2553 Webster Ave.
Bronx 58, N. Y.

Smucker & Co., Inc., A. F.
338 E. 23rd St.
New York 10, N. Y.

Sonora Radio & Television Corp.
325 N. Hoyne Ave.
Chicago 12, Ill.

Sparks Withington Co., The
2400 E. Michigan Ave.
Jackson, Michigan

Standard Radio & Television
209 Main St.
Fort Lee, N. J.

Starrett Television Mfg. Corp.
601 W. 26th St.
New York, N. Y.

Stewart-Warner Corp.
1826 Diversey Parkway
Chicago 14, Ill.

Stromberg-Carlson Co.
100 Carlson Rd.
Rochester 3, N. Y.

Symphonic Radio & Television Corp.
230 S. Spring St.
Los Angeles 12, California

Tech-Master Products Co.
123 Prince St.
New York 12, N. Y.

Telecraft Corp.
2 W. 15th St.
New York 11, N. Y.

Tele King Television Corp.
601 W. 26th St.
New York 1, N. Y.

Telequip Radio Co.
1901 S. Washtenaw Ave.
Chicago 8, Ill.

Telesonic Corp. of America
212 Concord St. 2 Prince St.
Brooklyn, N. Y. Brooklyn, N. Y.

Tele-Tone Radio Corp.
540 W. 58th St.
New York 19, N. Y.

Television Assembly Co.
540 Bushwick Ave.
Brooklyn 6, N. Y.

Television Development Labs., Inc.
252 W. 64th St.
New York 23, N. Y.

Television Industries
Brooklyn, N. Y.

Television Laboratories, Inc.
542 N. Parkside Ave.
Chicago 44, Ill.

Televista Corp. of America
114 E. 16th St.
New York 3, N. Y.

Televue Corp. of America
339 Laurel Ave.
Lakewood, N. J.

Telicor Corp.
151 Madison Ave.
New York 21, N. Y.

Telindustries Inc.
4921 Exposition Bldg.
Los Angeles, Calif.

Templetone Radio Mfg. Corp.
New London, Conn.

Tradio, Inc.
1001 First Ave.
Asbury Park, N. J.

Transvision, Inc.
460 North Ave.
New Rochelle, N. Y.

U. S. Television Mfg. Corp.
3 W. 61st St.
New York 23, N. Y.

Universal Television Co., Inc.
147 Montague St.
Brooklyn 2, N. Y.

Video Corporation of America
229 W. 28th St.
New York 1, N. Y.

Vid-craft Corp.
New York, N. Y.

Watterson Radio Mfg. Corp.
2700 Swiss Ave.
Dallas 1, Texas

Wells-Gardner & Co.
2701 N. Kildare Ave.
Chicago 39, Ill.

Westinghouse Electric Corp.
1354 Susquehanna Ave.
Sunbury, Pa.

Wilcox Gay Corp.
Charlotte, Michigan

Zenith Radio Corp
6001 Dickens Ave
Chicago 39, Ill.

Television PROJECTION SYSTEMS

RCA's Model 648 PTK large-screen television receiver which gives a 15"x20" picture.

By M. S. KAY

Current developments in projection TV makes possible large images from relatively compact television sets.

THE desire for relatively large television pictures is a natural one. One immediate advantage is the ability to view the screen for long consecutive periods without fatigue. Secondly, a greater number of persons can more comfortably view a large area than say a 7- or 10-inch screen. This is particularly desirable in sets installed in public places, such as auditoriums, taverns, theaters, and retail establishments.

Large images can be obtained in two ways: by using cathode-ray tubes having large viewing surfaces, or by projection. In the first method, practical considerations limit the screen to diameters of 20 inches. A tube having a diameter of 20 inches possesses a large physical volume, is awkward to manipulate, and expensive. Difficulties with these tubes are encountered at all points. In manufacture, the machines required for evacuating and sealing must be considerable in size. This either results in a limited production or a large capital investment. The large bulk of the tube increases the storage and transportation costs to an amount far beyond a proportionate value for a smaller tube. Finally, in the home, the cabinet, which is no minor item in the final pricing of the set, must likewise be large. Because of these difficulties, tubes with screens greater than 20 inches have not been commercially attempted. Sets using viewing tubes with 12, 15, or 20-inch screens are readily available, however.

The other approach to large screen television is by projection and to date two general systems have been employed. In one method, the image is formed on the screen of a small cathode-ray tube and then enlarged, using several projection lenses similar to those employed in motion-picture equipment. The chief disadvantage of this method is its low efficiency. Specially treated lenses, having a large aperture and good transmission of light, deliver to the viewing screen only about 6 per-cent of the light available on the screen of the cathode-ray tube. Consequently, even with intense images developed on the cathode-ray screen, the final image is bound to be dim and difficult to see.

As an illustration, consider the 5-inch projection tube, with its image of 3" x 4". The total area here is 12 square inches. If the image is enlarged to fill a screen 15 x 20 inches, the total area becomes 300 square inches, and the light which was originally concentrated in an area of 12 square inches is now spread out to cover an area of 300 square inches. The brightness is thereby reduced by the ratio of 300/12 or 25 to 1. This is, of course, assuming 100 per-cent transmission. If now we take into ac-

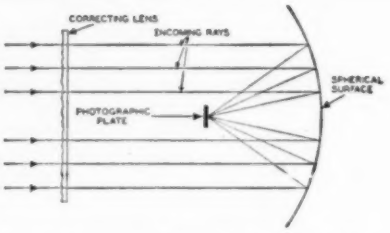


Fig. 1. Original Schmidt optical system as designed for astronomical telescopes.

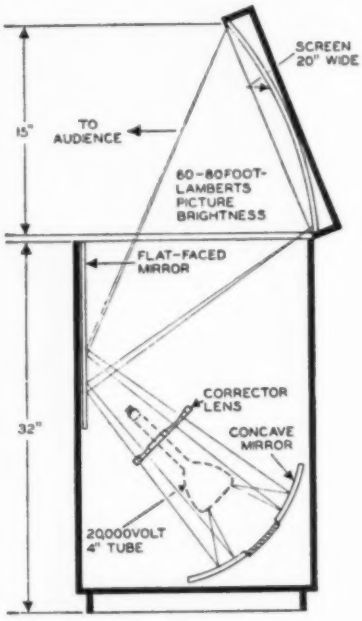
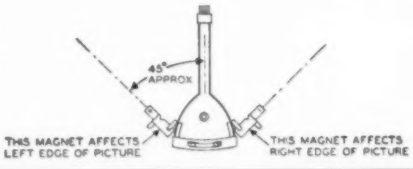


Fig. 3. The Philco projection system.



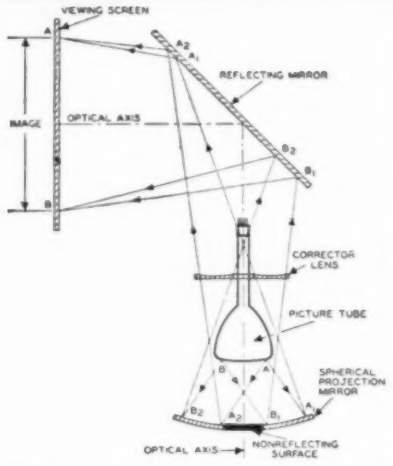


Fig. 2. The Schmidt system as adapted by G.E. and RCA for their television sets.

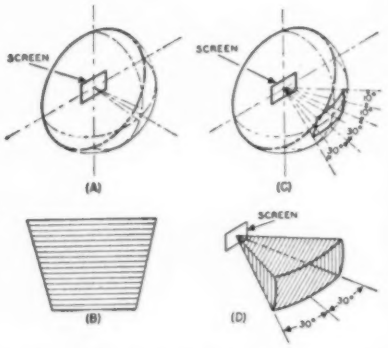


Fig. 4. (A) A non-directional screen will produce equal illumination at all equidistant points throughout a hemisphere. (B) A trapezoid. (C and D) The directional characteristics of Philco viewing screen.

Fig. 5. To produce a trapezoidal image on the CRT face, the magnets are attached to the tube as indicated in the drawing.

count that the over-all efficiency is only 6 per-cent, then the brightness is decreased by a factor of approximately 400 to 1 rather than 25 to 1.

Increasing the brightness of the image developed on the tube screen would be one partial solution to this problem, but the cost involved can readily place the equipment in the same expensive class as large cathode-ray tubes. A second approach to the problem, and one which appears to have greater possibilities, is to increase the efficiency of the lens system.

The first attempt in this direction was tried with the same lenses mentioned above and several difficulties were immediately encountered. In order to capture as much light as possible being emitted from the screen, the projection lens should be as large as possible. However, as the lens becomes larger, the number of distortions or "aberrations" multiply. (There are principally six aberrations that must be corrected; namely, chromatic aberration, spherical aberration, coma, astigmatism, curvature of field, and distortion.) To correct for these aberrations in a fairly satisfactory manner, we require several lens elements, say possibly three. However, in a wide angle system, more than three lens elements should be used. As more elements are added, the cost of the system rises. The greater the number of lenses in a system, the greater the total loss of light at the intersecting surfaces and the lower the over-all efficiency. Finally, with large lenses, the elimination of some aberrations is accompanied by a greater accentuation in others.

This was the impasse that faced television engineers until the adaptation of the Schmidt reflective optical system to television. Schmidt, an instrument maker at the Hamburg Germany Observatory, invented his optical system in 1931. The system, originally designed for astronomical telescopes, was built around a large spherical reflecting surface or mirror. See Fig. 1. Use of this type of reflecting surface offered several immediate advantages:

1. Mirrors are completely free of chromatic aberrations.

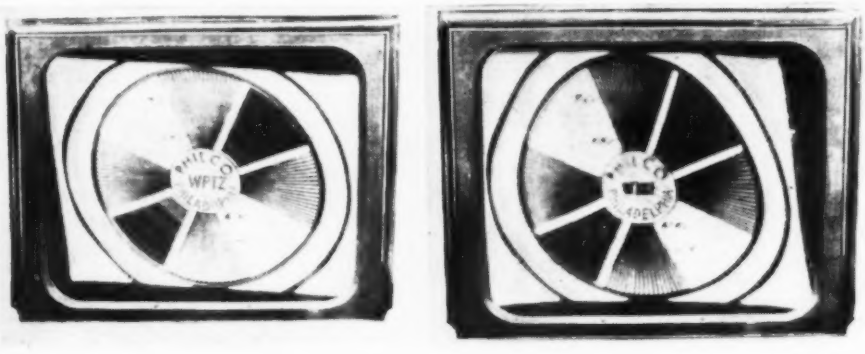
2. Under comparable designs of focal distance and diameter, a spherical mirror has a spherical aberration one-eighth that of a single lens. The need for correction is still present, but the problem is now considerably simplified.

3. By placing a small aperture or opening at the center of curvature of a spherical mirror, all of the monochromatic aberrations (except spherical aberration) are eliminated.

We are thus left with essentially two problems to solve. One is spherical aberration and the other is curvature of the field. The latter is quite simply resolved by curving the screen of the projection tube to suit the curvature of the mirror. To eliminate spherical aberration, a special correcting lens is employed. The correcting lens introduces into the beam an amount of spherical aberration which is equal to that introduced by the mirror, but is opposite in sign. As a result, the two neutralize each other, effectively removing the last great defect of the spherical mirror. With this lens in place, we have an optical system possessing an efficiency of 25 per-cent with magnification of 5. Compare this to the meager 6 per-cent obtainable using a refractive lens system.

For use in television receivers, there are several modifications of the original Schmidt lens system as designed for astronomical use. In *RCA* and *G.E.* projection receivers, the optical mirror is mounted at the bottom of the cabinet with its axis vertical, project-

Fig. 6. The visual effect of improper adjustment of the fixed magnets of Fig. 5.



ing the image straight up and onto a flat mirror inclined at 45 degrees to the beam of light and throwing the image on a translucent screen. See Fig. 2. The throw or distance between the correcting lens and the viewing screen will depend upon the diameter of the correcting lens and the spherical mirror. To increase the size of the projected image, the distance or throw must increase, necessitating large cabinets, a larger mirror, and a larger correcting lens. Eventually the optical system becomes awkward and bulky. A compromise is thus necessary between the size of the final image and the cost and size of the set. For each different throw or magnification, we require a different correcting lens. This, it will be noted, differs from a refractive lens system where the size of the projected image can be increased merely by changing the position of the lenses and the screen.

In *Philco* projection television receivers the arrangement of the optical system components is slightly different as shown in Fig. 3. The distance between the corrector lens and the screen is 33½ inches and variations of plus or minus 10 per-cent are permissible without leading to any serious deterioration of image quality. Each of the reflecting plane mirrors in all these optical systems are front-surfaced mirrors to prevent ghosts which would occur from reflections at the surface of the glass of a rear-surfaced mirror.

The translucent screen upon which the final image is projected has, in itself, directional properties which concentrate the incoming beam in certain desired directions. If the screen was a perfect diffuser of light, it would produce illumination which was equally visible all over the room. Graphically this could be shown as indicated in Fig. 4A. At all points throughout a hemisphere, whose center coincides with the screen, equal illumination would be received from the screen. Since many of the extreme angles of this hemisphere are never (or very seldom) used for viewing, due to foreshortening, it is advantageous to concentrate the light that would normally go to these points toward those angles that are most used for viewing. To achieve this, the translucent screen is made directional in the vertical and horizontal directions. Not only does this cause the final image to be brighter than it would be using the perfect diffuser screen, but it also presents the added advantage of greatly reducing the susceptibility of the screen to any stray light from lamps located in the viewing room.

In the *Philco* projection receiver, the screen is designed to have a viewing sector which extends 60° horizontally and 20° vertically. See Fig. 4B. To achieve this directivity, the screen contains a large number of vertical grooves, random shaped. These vertical grooves are responsible for the horizontal directivity of the screen. To achieve the 20° vertical directivity, the screen surface is made concave. See Fig. 3. The screen, in addition to its directional properties, also possesses a great many minute or lenticular elements, each of which redistributes or diffuses the light reaching it uniformly throughout the desired sector. The over-all brightness of this screen is about 50 foot-lamberts.

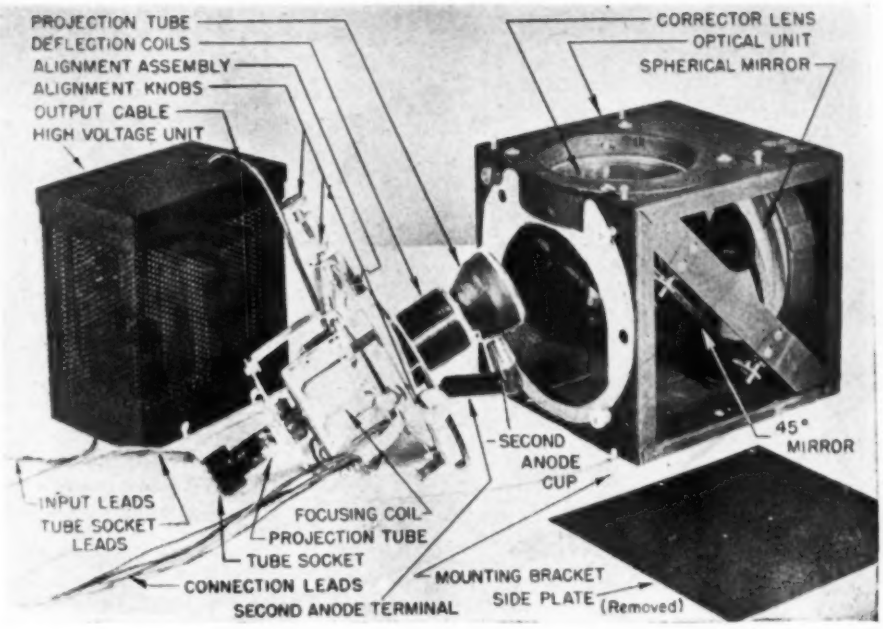


Fig. 7. The entire assembly, including the special power supply, as used in the North American Philips projection television system.

Since the optical system is mounted at an angle and projects on the screen at an angle, a rectangular image projected from the face of the picture tube would appear on the screen as a trapezoid (the image would have sloping sides with the top larger than the bottom). See Fig. 4B. On the other hand, by projecting a trapezoidal image from the tube, we obtain a rectangular image on the screen. This latter method is the one used in the *Philco* system.

Formation of the trapezoid pattern is achieved by applying a magnetic field at right angles to the electron beam. To produce this magnetic field, two oppositely polarized permanent magnets are mounted opposite each other on the end of the projection tube. See Fig. 5. An iron pole piece, curved to fit the sides of the tube, is attached to each magnet and is used to produce a strong field for deflecting the electron beam upward near the tube face. The oppositely polarized ends of the magnets farthest from the tube face cause a lesser and downward deflection of the beam before it is deflected upward. The result is the same as that which would be produced if the face of the tube were tilted inward; the distance the beam travels to the bottom of the image is reduced and the distance to the top is increased. This creates the desired trapezoidal pattern. The magnets are adjusted for the proper keystoning pattern by moving them toward (parallel to the

(*Continued on page* 150)

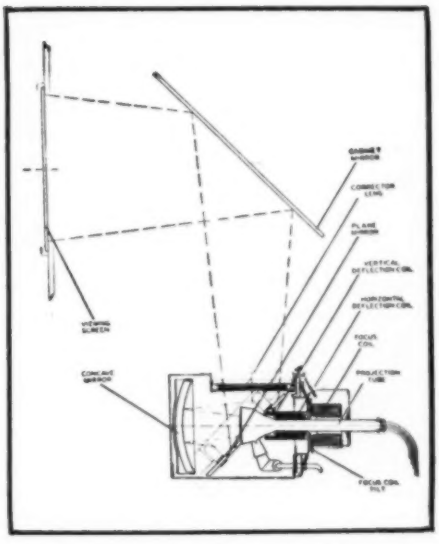
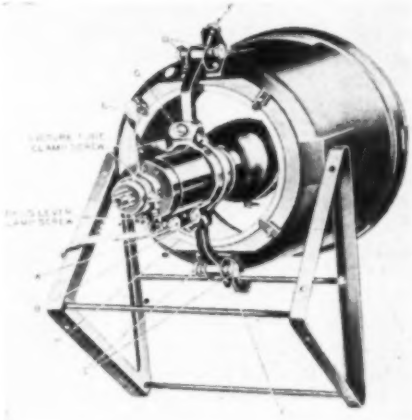
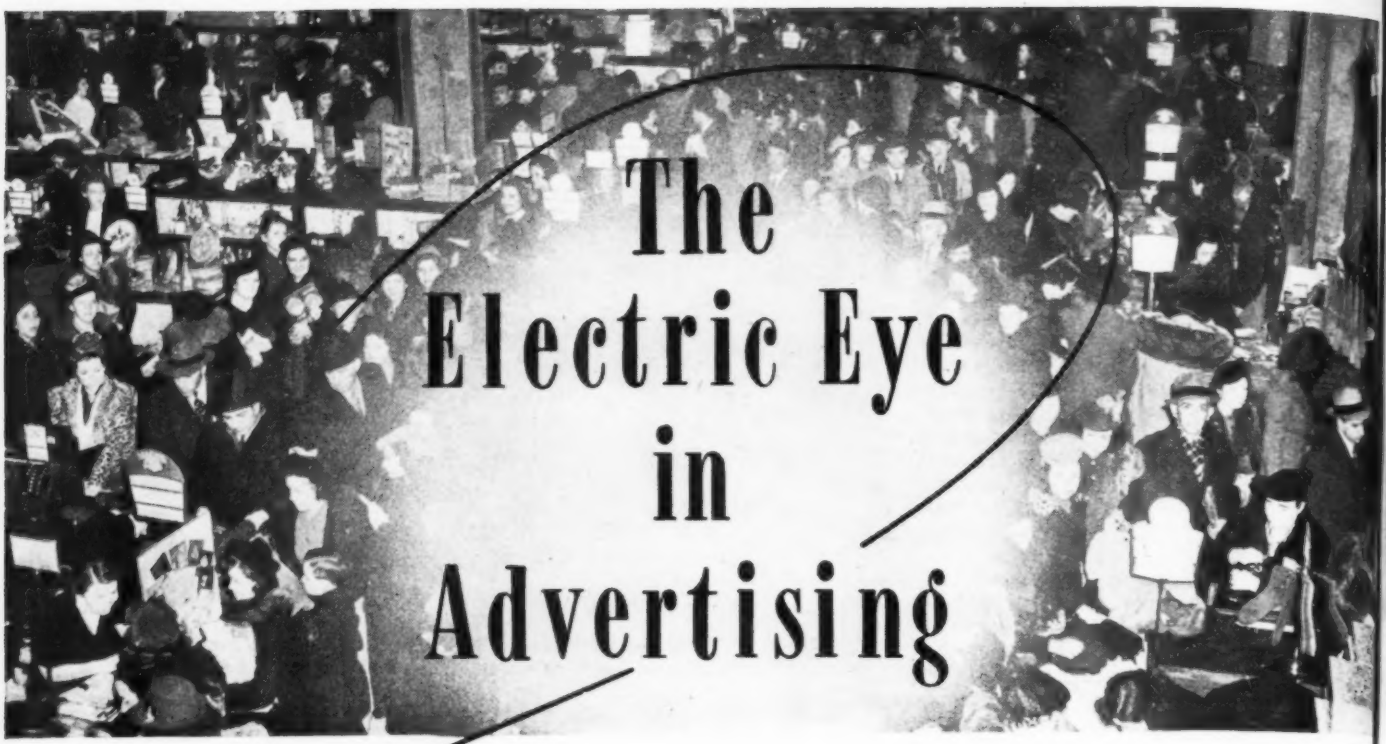


Fig. 8. The various components of the optical unit of the Philips projection set.

★ ★

Fig. 9. The "optical barrel" in Philco and RCA receivers. The points lettered A through H are physical positioning adjustments.





The Electric Eye in Advertising

By
A. EDELMAN

A real sales promoter—the "electric eye" incorporated in novel gadgets will attract the interest of potential customers.

MOST of our collective electrically-disposed brains are so engrossed with radio, recordings, television, and other forms of communications electronics that we tend to overlook the amazingly varied jobs handled by the workaday electric eye relay, or photorelay. I would like to tell you about some of those jobs, and how my friend Xavier made them his source of income.

When I first met Xavier he was a thin, thoughtful, seedy-looking soldering-iron mechanic not long out of the Army and its unfailing three squares daily. He entered my office to borrow a photorelay, a man with small resources, a wife in prospect, and big ideas. Now, months later, he has invited me to bring you readers along on a visit in the neighborhood, to see how he has applied the electric eye to good use in advertising.

Following Xavier's instructions, we arrive at the Roebuck Hurn department store at dusk, just in time to see their big neon signs light up, more or less at the same time. Xavier has told me how he placed photorelays in some of the upper story windows, pointed towards the sky; and how, when the sky darkens sufficiently, these relays turn the signs on. Each photorelay operates one or two neon signs.

I remember vividly the trouble he had with the first of these units; he had placed it right near the sign it was to control, but inside the window. When it became dark that first day, the sign went on, and its light reached into the phototube, so that the phototube promptly turned off the sign. This went on quite merrily, until the contactor overheated, and someone called the store electrician. After that, the electrician had to be pacified with the gift of one of our photorelay kits for his high school age son. The sign control was adjusted by making sure that the sign could not shine into the phototube, and also by putting in a time-delay circuit so that it would take ten or fifteen seconds to turn the sign either on or off. That was to fool the clerks who started showing their friends how they could turn the sign on by placing their hands over the electric eye light entrance. By permission, I am passing along the circuit details to you, on the chance you may want to use it sometime. It's all in the diagram of Fig. 1 and the explanation below the diagram.

Well, now we are at the store, and there are the show-windows with all their displays. Xavier asked me to watch out for the second window, and to walk by after it was cleared of people, so that we could see just what happens. We do that, and notice the spotlight shining at us, and the phototube box near it picking up the light reflected from our clothes. Xavier explained to me sometime back how a disturbance to the amount of reflected light entering the phototube was amplified as an a.c. signal, and how this caused a relay to operate. This circuit, with its voltage regulators, high gain amplifier, bandpass filter, resistance-capacity coupling, and time-delay arrangements, is too complicated to explain here, so I won't try. But it certainly does work fine, because as we pass by, the window seems to come to life. A fast-flashing lamp somewhere in the window dazzles, and cannot be ignored; it is almost hypnotic. We go to the window, of course, and are able to see how Xavier laid out all of the electrical stuff without taking any room away from the pajamas and blankets. Judging by the crowds that follow us, a lot of people are going to know all about those pajamas soon.

That fast-flashing lamp, by the way, is another piece of photorelay work, and is something like the sign control that didn't work correctly, which I just described. The photorelay controls the big lamp, and when the lamp goes on, the light from it reaches into the phototube, and causes the relay in there to turn the lamp off. When the lamp is off, the darkness at the phototube causes it to switch on again. The effect is better when the lamp does not switch on and off too fast, and so the phototube is adjusted to require

the maximum amount of light that the lamp can give it. This means that the lamp has to come up to full brightness each time, before it can switch off. Also, a slow carbon lamp is used to shine into the phototube, while the main light in the window is obtained from tungsten lamps. That slows the relay operation down some more. As for the photorelay itself, almost all of the circuits in my new book* will do, because the circuit is not a bit critical, as long as no part of it, like the relay contacts, has been overloaded.

We enter the doorway of the store. There is a "bong" to announce us, and a salesman smiles us officiously into the furniture department. That was the door signal Xavier fussed with for days. You might suppose a simple beam of light across the entranceway was an easy job; but it so happens that the sun and daylight enter those big show windows strongly part of the day, so that the phototube was never sure to be darkened by the shadow of a person entering, to cut off a weak little beam of light across the entrance. Xavier fixed that, after he found out what the difficulty was, by protecting the phototube against daylight as much as he could, and then by using a resistance-capacity coupled circuit to make sure that different amounts of daylight that got in anyway would not change the bias on his amplifier tubes. His circuit is so good that it is all covered in Fig. 3.

We get rid of the salesman fast merely by telling him that we are not buying anything today, and start walking down a long aisle lined with furniture. A showcase up ahead suddenly lights up like a Christmas tree, and a display near it begins to turn around and around. That's because Xavier ambushed us again with an electric eye, and now we can't help but see the new clocks and radios. This time it's the same circuit as the door signal electric eye, except that instead of a chime tone, the relay started off a timing motor, which had to make one full turn before it could stop. While it turned, the lights were on in the showcase, and the display motor turned around and around.

We don't stay long here, and after we leave, the display goes to sleep again, saving wear, tear, and electricity. The boss of this store must be a real pennypincher to have Xavier work it out that way.

Now we are at phonograph records, and there is a crowd of people around a sign that says *"Talk over the Light Beam—Free."* There are. two reflectors, one at each end of the space, and a man at one end is talking to a lady at the other, using telephones. The small boy in the middle is up to something—he lifts that umbrella into the light beam and annoys the talkers by cutting them off. Perhaps we should tell Xavier to raise the reflectors; but then, maybe not, because after all, the people are laughing, having fun, and buying records.

That light-beam job is just like a crystal microphone preamplifier. The phototube is in series with a 5 megohm resistor, and with a 90 volt battery, and the resistor is coupled through a condenser into a standard audio amplifier. The output is coupled to a ¼ watt neon lamp through a transformer, and with some d.c. bias to make sure that the lamp doesn't extinguish. It's not a bit difficult, if you fuss with it a little, and don't try to put the reflectors too far apart. The quality of the voice will not be very good, of course, unless you know about frequency range, and pick over the circuit with your oscillograph to

(*Continued on page* 148)

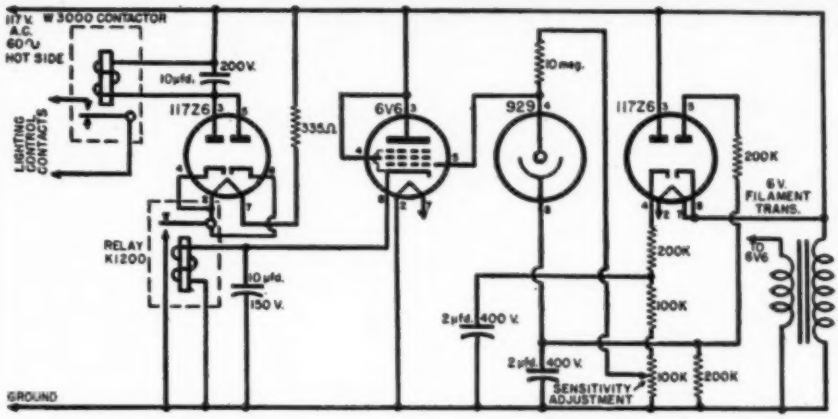


Fig. 1. This photoelectric sign lighting control circuit is one that you will use in several different forms so it is well worth the time and effort to build it soundly. A 6-volt transformer is used for heating the 6V6 amplifier tube cathode, and a 117Z6 dual rectifier for furnishing both a plus-to-ground and a minus-to-ground voltage for the grid circuit of the 6V6. A phototube, an amplifier tube with a relay in its cathode circuit, a time delay tube (another 117Z6), and a contactor complete the circuit.

The two voltages for the grid circuit are well filtered, and furnish enough voltage to bias the phototube so that it will work sensitively. If you do not have a Type 1P24 phototube, then any vacuum-type, such as the 929, will do. Be sure not to use electrolytic condensers for filtering the grid circuit voltages; the impedances here are high and when the electrolytics change their leakage, as they do continuously, the voltages will be disturbed. The phototube and the 10 megohm resistor divide the voltages obtained from the 117Z6 and, when the phototube is dark, takes most of the voltage for itself. This raises the grid of the 6V6 and the cathode has to follow the grid, so the relay gets the voltage. By putting the relay in the cathode circuit, instead of in the plate circuit, there is a high negative feedback, no amplification of voltage, but lots of current amplification and stability of adjustment.

You might have noticed that raw a.c. is used on the plate of the 6V6. This doesn't matter because nothing happens when the plate is negative. The tube merely operates during about half of each a.c. cycle, which is just as good as operating all the time, and there is less work for you in building it.

When the relay operates and stays in an operating condition for awhile, it heats up the 117Z6 time delay tube, which is just a rectifier, and this slowly pulls over the contactor to turn on the lights. In the same way, when the relay releases the next morning, the 117Z6 lets go after a delay and slowly opens the contactor.

Be sure to adjust the relay so that it has a fairly wide margin between "operate" current and "release" current, as this prevents any chattering of the relay contacts. Also be sure that the lamps or signs that are on the relay contacts do not shine into the phototube, unless you want to build a slow oscillator.

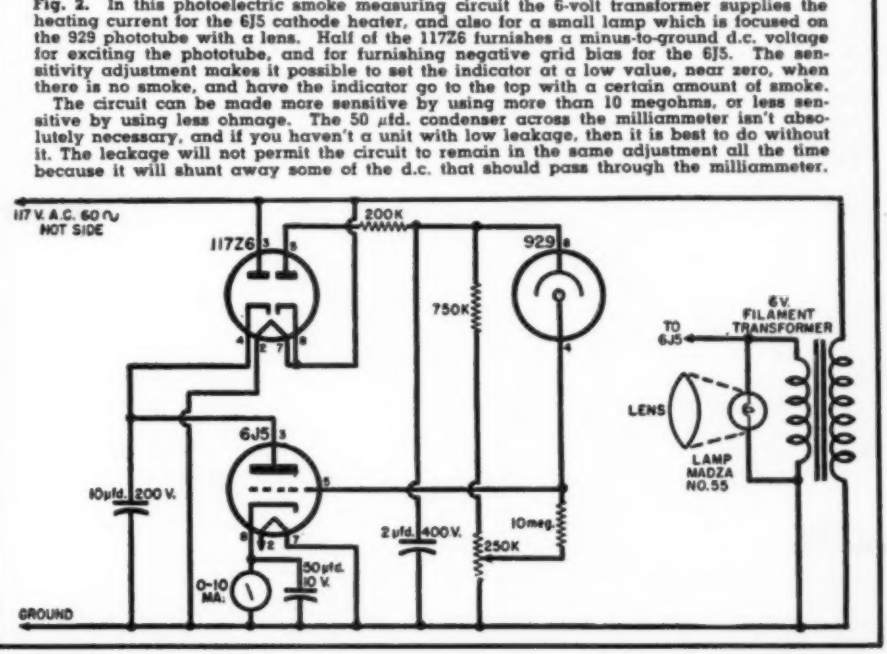


Fig. 2. In this photoelectric smoke measuring circuit the 6-volt transformer supplies the heating current for the 6J5 cathode heater, and also for a small lamp which is focused on the 929 phototube with a lens. Half of the 117Z6 furnishes a minus-to-ground d.c. voltage for exciting the phototube, and for furnishing negative grid bias for the 6J5. The sensitivity adjustment makes it possible to set the indicator at a low value, near zero, when there is no smoke, and have the indicator go to the top with a certain amount of smoke.

The circuit can be made more sensitive by using more than 10 megohms, or less sensitive by using less ohmage. The 50 μfd. condenser across the milliammeter isn't absolutely necessary, and if you haven't a unit with low leakage, then it is best to do without it. The leakage will not permit the circuit to remain in the same adjustment all the time because it will shunt away some of the d.c. that should pass through the milliammeter.

* Edelman, A.: "Electric Eye Circuits and Relays in Theory and Practice." Photobell Company, 116 Nassau, New York 7, N. Y.

Mac's RADIO SERVICE SHOP

By JOHN T. FRYE

Mac and the Morning Mail

BARNEY was busy at the service bench putting a new volume control in an a.c.-d.c. midget, while behind him the boss-man himself was making some adjustments on a TV console. The bright May-morning sunshine flooding through the big plate glass windows of the front room seemed to dim the usual brilliance of the fluorescent-lighted service department.

What Mac was really doing was adjusting the ion-trap on the neck of the 10BP4 picture tube, and to do this he was making use of his latest "invention." This invention—which Barney had solemnly dubbed the *Reflectomagnovisor*—was nothing more than one of those swivel-mounted, reversible shaving mirrors with a plain mirror on one side and a magnifying mirror on the other, mounted on a folding music stand. The mirror was mounted in place of the original music rack, so it could be adjusted to any height and turned and tilted through any angle. This portable device permitted Mac to stand behind a TV set and to see a reflection of the pattern on the face of the tube while making the adjustments usually controlled from the rear of the set. He could have his choice of a wide-angle, undistorted view of the whole tube face or a highly-magnified reflection of a particular portion of that screen—a selection that came in very handy when working with the *linearity*, *drive*, and *focus* controls.

As Mac decided that he had the trap at the exact spot and in the best possible position on the neck of the tube for maximum brilliance of the raster, Miss Perkins brought in the morning mail and thumped it down on top of the receiver.

"For once," she remarked acidly, "you actually have a first-class letter or so in that mess."

Miss Perkins had a very low opinion of the flood of catalogs, circulars, technical bulletins, and advertising postcards that made up the bulk of the radio shop mail. Mac sat down on the end of the service bench and began to gouge open the envelopes with the long slender blade of a dialknob screwdriver.

"Hey, Red," he said as he waved the first letter about, "do you remember my telling you about those 35Z5's, 35Z3's, etc., that develop a funny condition so that the smallest jar will cause them to make a noise? Well, I wrote to this tube manufacturer and asked if he could tell me why they did this. He said to send him some samples of the noisy tubes, and I did. In this letter he says that an inspection reveals that under certain conditions some of these tubes develop a condition wherein they actually generate r.f. pulses when they are jarred ever so slightly. These pulses are picked up by the antenna and are amplified by the set. He remarks—as we found out, too—that the noise is worse in those sets in which a built-in loop is quite near the rectifier. He suggests that putting a shield around the rectifier tube will help reduce the noise."

"Do we start shielding those noisy tubes or do we continue to replace them as we have been doing?" Barney wanted to know.

"I think that in most cases we will continue replacing the tubes," Mac said after a little reflection. "A 35Z5 usually has a short life anyway, and if we cut off its ventilation by putting a shield around it, the set would probably be back in a few days with a burned-out rectifier; then we would have to put in the new tube that we might just as well have put in in the first place."

Having made this decision, Mac laid aside the letter and butchered open another envelope with his screwdriver. "Well, well," he muttered as he glanced over the page, "we seem to have hit the jackpot today. This letter takes up another of our problems. I have always wondered exactly what happens to those electrolytic condensers that become noisy without developing either an open or a shorted condition. You know—the ones that make a static-like noise until you bridge a good condenser across them; and then the noise stops, only to start up again a few minutes later.

"Well, I saved up a few of these that we had taken out of sets and sent them in to this condenser manufacturer. Some were his; others were of competitive makes. This letter says that the chief engineer of the company inspected the condensers and found that in every case there were very small variations in the contact resistance of the leads. In certain critical circuits, these variations would cause noise. He goes on to say that these variable resistances, tiny though they were, have now been eliminated in their own products."

"What do you suppose he means by 'certain critical circuits?'" Barney wanted to know.

"I think he means circuits in which an abrupt change of voltage, even though it is slight, would produce a sort of r.f. pulse. We know that the noise *is* of an r.f. nature, for when one of these noisy sets is playing on the bench, you can pick up the noise on other sets operating nearby; moreover, when the volume control is turned down so that an r.f. signal cannot be detected and fed through into the audio amplifier, the noise disappears. Possibly the little abrupt changes of voltage due to the variations in the contact resistance pulse-modulates the oscillator in the set and produces a noise in much the same way that a keyed oscillator or r.f. amplifier produces key clicks."

Barney nodded sagely in agreement with this and went on with his work while Mac continued reading still a third letter.

"Hey, Mac," Barney suddenly interrupted, "what's the idea of this coil of insulated wire wrapped around this .2 μfd. condenser? The circuit diagram shows the coil and condenser in series between the 'B-minus' point and the chassis, and then there's a quarter-meg resistor across the whole works."

"What does it look like?" Mac asked quizzically.

"It *looks like* a series-tuned circuit," Barney said cautiously.

"And by a happy coincidence, that's exactly what it is!" Mac said.

"Well, come on!" Barney said impatiently. "Tell me more! What's a tuned circuit doing in that out-of-the-way place? Why use it instead of the usual condenser-and-resistor combina-

(*Continued on page* 158)

Broadcasting Station on Wheels

When a news story breaks in Oklahoma, WKY is on the spot with instant coverage—thanks to a complete and unique studio which travels to the story locale.

COMPLETE communication facilities for use in emergencies, and as a showpiece for more normal remote broadcasts are housed in the custombuilt "broadcasting station on wheels" now roaming the plains of Oklahoma for WKY, the NBC affiliate in Oklahoma City.

A study of special events programming in Oklahoma by P. A. Sugg, station manager, revealed the need of more versatile facilities for such work. As a result, a new and completely equipped remote studio was created. The 29 passenger bus was custombuilt by *Flexible Company* at their Loudonville, Ohio plant, following specifications carefully detailed by the WKY engineering department.

Immediately behind the driver are seats for announcers, engineers, and others on special assignment. The center section contains the control room where all equipment a studio requires is shock mounted, enabling the unit to operate while in motion.

Included in the control room are four AM-FM cue and talkback receivers, a 150 watt AM transmitter and two turntables with recorders adjustable to bus position, plus record storage and seating space.

The back third of the unit is a maroon and gray appointed studio, sound treated and large enough to accommodate nine people. There are two Pullman-type tables for broadcasting, four microphone outlets and seats for five across the back.

The luggage compartment contains a 2 kw. gasoline power plant, a 50 w. public address system, a *Bell* telephone transmitter and receiver and an FM police receiver.

Sound power phones are used for communication within the unit and a *Bell* highway telephone provides communication with established circuits throughout the state of Oklahoma.

This equipment has already proved its value. For example, the remote studio was parked on the campus of the University of Oklahoma, 20 miles south of Oklahoma City recently, where a program was scheduled for that afternoon. Word of a disastrous fire at Woodward, 150 miles northwest of Oklahoma City, was relayed to the vehicle by the *Bell* highway telephone. Plans were quickly changed, the remote studio pulled out for Woodward, further instructions were given by telephone as the vehicle sped along the highways, and in less than three hours an eye-witness broadcast was on the air from Woodward.

A railed platform atop the remote studio provides an unobstructed view for on-the-scene broadcasts. AM-FM transmitting and receiving antennas are also located along the top of the vehicle.

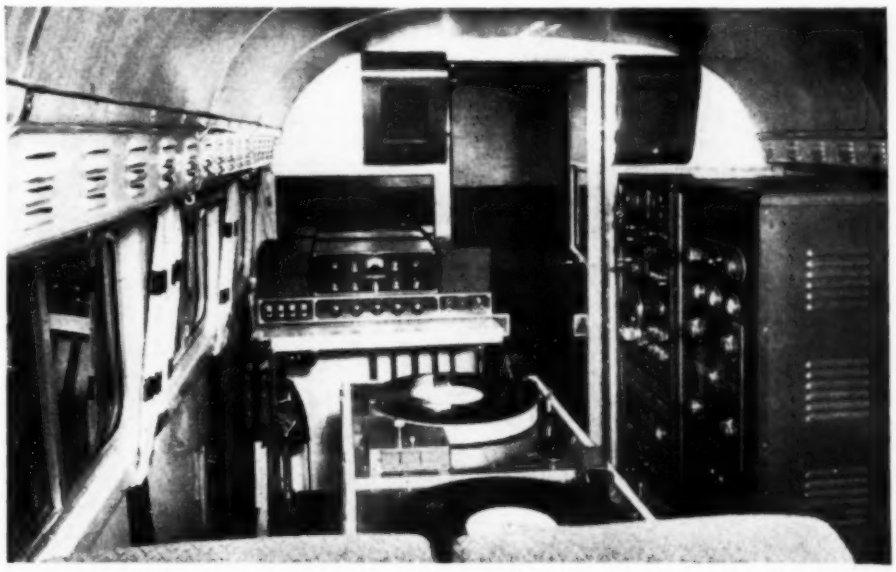
Power outlets, microphone and telephone line inputs were installed outside the unit, along the body frame supports.

Accessories such as fog lights, siren, spotlights and public address speakers add the final touch.

Jack Lovell, chief engineer, Gene Lyons, field supervisor, Ed Callahan, engineering supervisor, and Bob Hayward, engineer, worked steadily for nearly two months making the installations that make the remote studio one of the finest in America.

—30—

View of mobile control room showing transcription tables, console, highway-type telephone, sound power phone, speakers, AM and FM receivers, and AM transmitter.



A Briefcase HAM PORTABLE

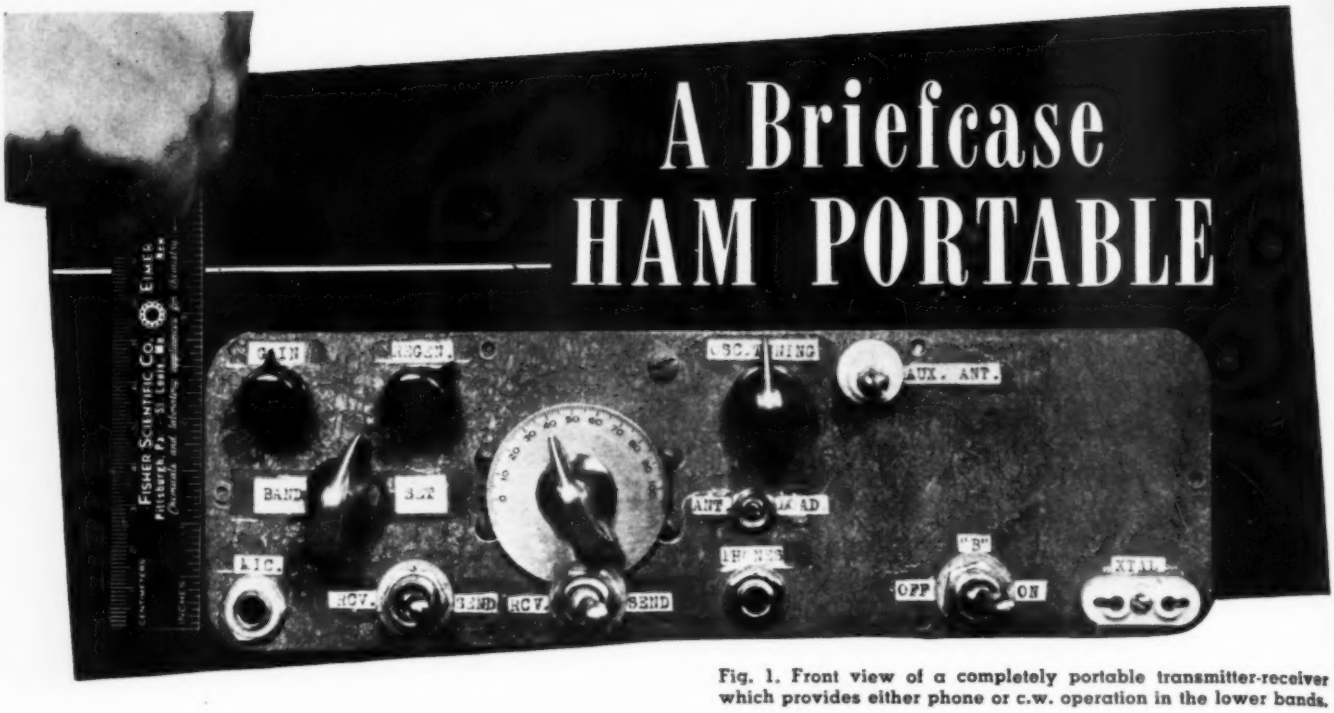


Fig. 1. Front view of a completely portable transmitter-receiver which provides either phone or c.w. operation in the lower bands.

By E. CAMPAINE, W3KWP and M. F. JUDKINS, W3AC

A standard briefcase or the glove compartment of a car will readily hold this tiny ham "station."

BRIEFCASE ham portable, portable mobile, vacation portable —call it what you will but this little combination transmitter-receiver represents the ultimate in compactness for two-way communication on both phone and c.w. for the low frequencies.

The urge to build some type of battery-operated equipment was fulfilled when surplus gear began to flood the market. The vital parts used in the construction of the rig are all from surplus items—parts that might have otherwise been discarded. Fig. 6 is a front view of the complete station including headphones, microphone, key, loading coil, and antenna. Fig. 5 is the rear view of the unit showing the meter, key jack, and modulator-c.w. switch.

Portability Without a Truck

This equipment is really portable and readily fits a standard briefcase or the glove compartment of the average car. Fig. 1 is a front view of the cabinet. The ruler clearly indicates that the over-all height of the unit is scarcely three inches!

Many articles have been written about the so-called "vest pocket" transmitter but usually a bushel basket is required to hold the rest of the paraphernalia that normally goes to make up the complete station, i.e., the receiver, antenna, batteries, etc. The auxiliary equipment used with this station includes a throw-out antenna, which when folded is less than 16 inches long and when jointed ten feet, six inches; an antenna loading coil, headphones, a key, a microphone, and a plug-in meter. Everything else is housed inside the case—even the batteries.

The Circuit

Fig. 4 shows the circuit as it finally evolved. It is a compromise between the ultimate in compactness and efficiency yet it provides absolute minimum "A" and "B" battery drain. Alternatives could have provided an r.f. stage ahead of the detector and a Pierce oscillator power amplifier transmitter but both "A" and "B" current drain would have been doubled.

Receiver Details

The receiver is conventional and uses a 1T4 amplifier tube as a regenerative detector impedance-coupled to the 1S4 audio. Bias for the 1S4 amplifier tube is provided by three penlight cells which are cemented to the under-

Fig. 2. Top view of the transmitter-receiver unit showing the location of the coils, battery, and other top-chassis parts.

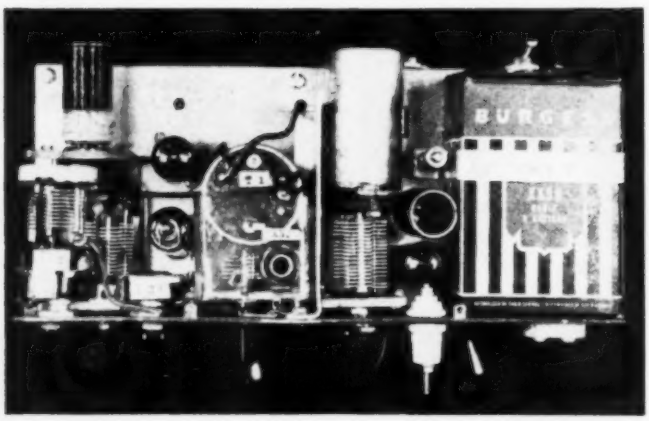
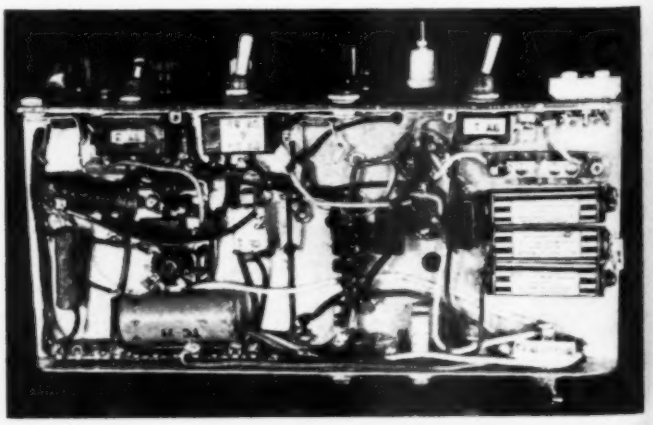


Fig. 3. Under chassis view of portable. Note that although the set is compact there is no undue crowding of the components.



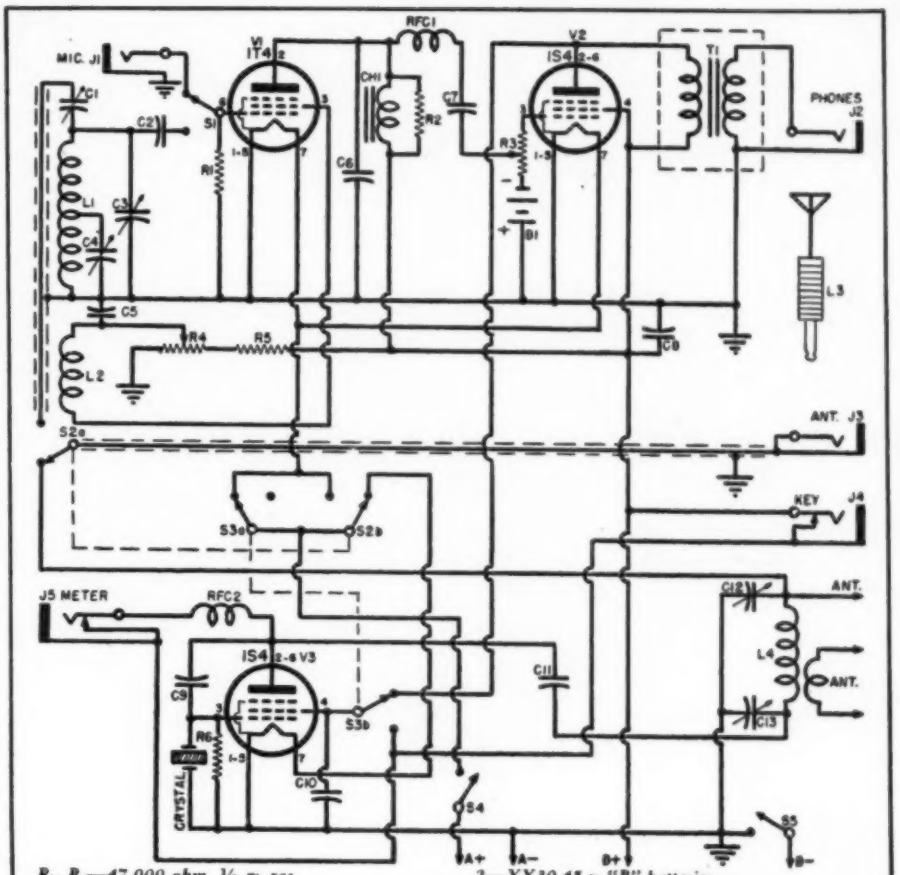
side of the chassis. Since no current is drawn by these batteries their life can be considered that of shelf-life batteries. When using phone the 1T4 detector becomes the speech amplifier by switching the microphone into its grid circuit, and the 1S4 audio tube choke-modulates the screen grid of the 1S4 oscillator tube. The output transformer was salvaged from a surplus BC 453A. It serves as an output transformer when receiving, while the primary alone is used as the modulation choke. Because the headphones remain in the circuit at all times, complete monitoring of voice transmissions is possible.

As can be seen in Fig. 1, the 140 $\mu\mu$fd. bandset condenser, C_2, is mounted on the left side of the front panel, the gain control, R_3, is in the upper left-hand corner, and to the right of gain control is the regeneration control, R_4. The plug-in coils, L_1, L_2, which can be changed with the shield in place, and the antenna series condenser, C_1, are mounted on a piece of lucite, bent into an angle and bolted to the chassis, as shown in Fig. 2. The 1T4 detector appears directly behind the regeneration control in Fig. 2 and farther back is the 1S4 audio tube. The output transformer, T_1, is mounted to the right and is in the center of the chassis. Visible through the lucite angle bracket used to mount the antenna jack, J_3, is the bandspread tuning condenser, C_4. A vertical aluminum shield, bolted to the chassis and the front panel, separate the receiver and the transmitter.

The Transmitter

The transmitter is nothing more than a 1S4 crystal oscillator with a small feedback condenser to help some of your sluggish crystals perk up and take notice. The plate circuit is metered by a 0-25 ma. meter, through a closed-circuit jack, J_5. The assumption that a simple pi-coupler will load any length of wire or anything from a wet string to a bed spring proved to be untenable. Designed to load the throw-out surplus antenna, this pi-coupler in conjunction with a loading coil can't miss, and no one can deny the reliability of the low impedance link when working the rig on the home antenna.

(*Continued on page* 120)



R_1, R_6—47,000 ohm, ½ w. res.
R_2—250,000 ohm, ½ w. res.
R_3—250,000 ohm pot.
R_4—25,000 ohm pot.
R_5—30,000 ohm, 1 w. res.
C_1—30 $\mu\mu$fd. midget var. cond.
C_2, C_8—100 $\mu\mu$fd. mica cond.
C_3, C_{13}—140 $\mu\mu$fd. midget var. cond.
C_4—35 $\mu\mu$fd. midget var. cond.
C_5—.002 μfd. mica cond.
C_7—.005 μfd. paper cond.
C_9—8 μfd. 150 v. dry elec. cond.
C_{10}—Feedback cond. (see text)
C_{10}—.01 μfd. mica cond.
C_{11}—.001 μfd. mica cond.
C_{12}—450 $\mu\mu$fd. postage stamp var. padding cond.
RFC_1, RFC_2—2.5 mh. r.f. choke
S_1—S.p.d.t. toggle sw.
$S_{2a,b}$, $S_{3a,b}$—D.p.d.t. toggle sw.
S_4—On gain control
S_5—S.p.s.t. toggle sw.
J_1, J_2, J_3—Single circuit jack
J_4, J_5—Closed circuit jack
T_1—Output & mod. trans., 7500 ohm plate load to 300 ohm sec. (unit from a surplus BC 453A, 454A, or 455A transmitter was used)
CH_1—60 hy. subminiature choke
B_1—Three series-connected penlite cells
2—XX30 45 v. "B" batteries
1—1.5 v. flashlight cell and mounting clip
1—0-25 ma. meter
L_1*—3500-4000 kc.—35 t. #24 en.; 7000-7300 kc.—13 t. #24 en. tapped at 9 t. from gnd. end
L_2*—3500-4000 kc.—20 t. #32 cotton; 7000-7300 kc.—18 t. #32 en.
L_3—3500-4000 kc.—72 t. #32 en.; 7000-7300 kc.—60 t. #32 en. both on bakelite body of standard phone plug connected to single circuit jack to "receive" antenna.
L_4*—3500-4000 kc.—45 t. #24 en.; 7000-7300 kc.—21 t. #24 en.
* All coils closewound on ¾" dia. forms (Amphenol 24-6H)
Xtal—Crystal for each operating frequency desired
1—1T4 tube
2—1S4 tubes
Additional parts needed
1—Button feedthrough insulator for aux. antenna
1—Crystal socket
3—7-pin miniature tube sockets
1—Crystal microphone
1—Surplus throw-out antenna (AN 131 A with PL 55 plug mounting)
1—Terminal strip
3—Single circuit plugs

Fig. 4. Schematic diagram and parts list for the portable transmitter-receiver.

Fig. 5. Back view of unit showing plug-in milliammeter in place and the operating key inserted in the proper circuit jack, J_4.

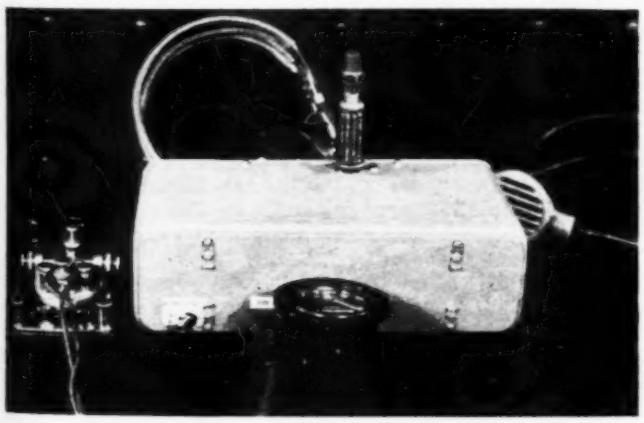
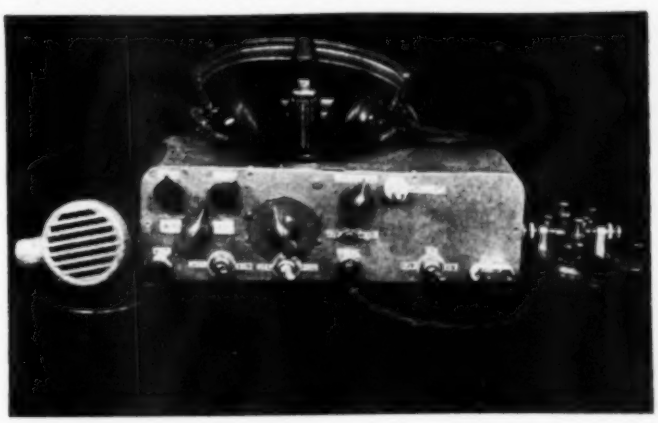


Fig. 6. Front view of unit with all of the operating accessories, headphones, mike, key, and throw-out antenna, assembled.



A Dual-Purpose Frequency Meter—V.F.O.

By
G. L. COUNTRYMAN,
W3HH, W1RVE
Commander, USN, Electronics Officer
Boston Naval Shipyard

Over-all view of completed unit. The v.f.o. output is adequate to drive an 807 tube either as a straight amplifier or as a frequency multiplier.

Complete construction details for a "ham" unit that can be used either as a v.f.o. to drive a transmitter or as a frequency meter for both receiver and transmitter frequency measurements.

THE basic unit to be described is similar to a v.f.o. designed by Don Mix about two years ago and written up in the 1948 *ARRL Handbook*. The main differences are the substitution of a mixer tube for one isolation stage, minor changes in the electron coupled oscillator components, and some refinements such as the inclusion of a dial that will read direct to 2500 divisions.

Provision is made for coaxial connection to the transmitter when the unit is used as a v.f.o., and for r.f. input and headphone output for the direct checking of a transmitter frequency or for monitor uses.

The v.f.o. output is adequate to drive an 807 tube either as a straight amplifier or as a frequency multiplier. No provision has been made for keying the unit so one or more of the following stages must be keyed, preferably in the cathode. A convenient switch in the center tap of the high voltage winding on the transformer cuts the v.f.o. on or off as desired.

Referring to the photographs, the dial on the 3" x 4" x 5" ECO box can be read directly to 2500 dial divisions in 180 degrees rotation. These dials sell new for around $7.00 but are included with BC375E tuning units which currently retail on the surplus market for around $1.25. The dial shown was removed from one of the used surplus tuning units.

The left hand switch is in the a.c. line and the right hand switch is in the center tap of the high voltage winding of the power transformer. Between the switches is a 6.3 volt pilot light connected to the filament winding of the power transformer. The bulb is removable from the front of the chassis. A two-terminal strip (*Millen* No. 37302) is on the rear of the chassis for attaching the a.c. line cord, and on the right hand side of the chassis are the phone jack, the coaxial output terminal, and a binding post mounted on insulated grommets for coupling r.f. input, if necessary, in connection with the use of the unit as a frequency meter. A two or three-foot length of wire attached to this binding post provides sufficient input for checking even a low power transmitter, and insures adequate headphone volume.

Behind the ECO box are, left to right, the 6F6 isolation stage, the 6L7 mixer tube and an octal base plug-in 20-20 μfd. filter condenser obtained at surplus for 35 cents. The 6SK7 ECO tube is mounted on top of the ECO box where its heat will not affect the frequency or stability of the oscillator. Behind the filter condenser is the VR105 regulator tube and at the rear, the rectifier tube. On the rectifier tube socket, pins 3 and 4, pins 5 and 6, and pins 2 and 7 are connected together. This arrangement permits the use of any of the octal base rectifier tubes. The power transformer occupies the left hand rear corner of the chassis.

The ECO

The ECO itself is contained in a *Parmetal* 3" x 4" x 5" utility box and the wiring diagram is self-explanatory. The coil, L_1, was picked up at surplus for a dime. It is marked "L-205" and is about 1½" long. Two threaded holes in one end permit fastening to the side of the ECO box. The coil consists of 24¼ turns of No. 20 tinned copper wire, wound on a threaded ceramic form ¾" in diameter with the individual windings spaced approximately the diameter of the wire and is tapped 3¼ turns from one end.

The tuning condenser, C_1, is mounted on the rear of the box and an insulated shaft is coupled to the rear extension of the condenser shaft then, in turn, coupled to the dial. Incidentally, the dial must be mounted first, and the holes laid out with great care, as the dial will just exactly fit within the three-inch dimension of the box. As the panel from which the surplus dial was removed is thicker than the side of the ECO box, it is necessary to use washers with the three screws which secure the dial. After the dial is installed, the hole on the opposite side of the box for the condenser mounting may be made, being careful to locate

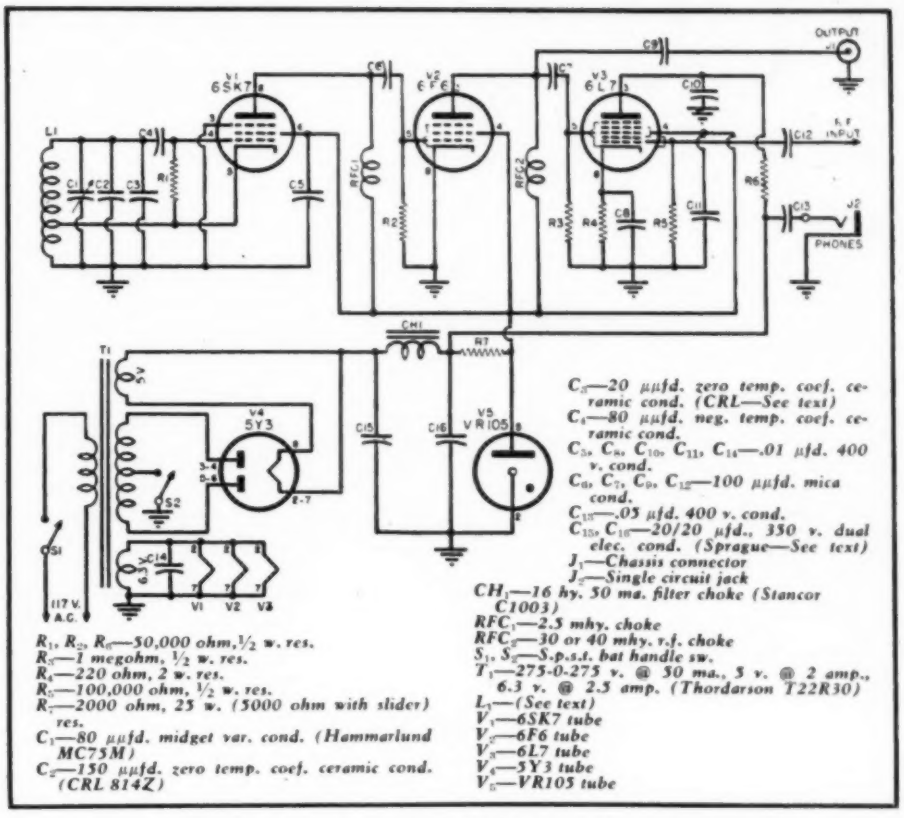
it so that the condenser shaft and the dial coupling will be perfectly centered. If that is not done, the dial will bind and not turn free. Care must also be exercised not to damage or even scratch the worm gear in the dial, as any defect will cause the dial to bind at that point and not operate smoothly.

Considerable experimenting was done with the various fixed capacities and the proper temperature coefficients required to insure continuous stable operation. The arrangement finally adopted has no appreciable frequency drift thirty seconds after the filaments are turned on, and no changes in calibration have been noted over a period of several months, checking against an accurate frequency meter with an accuracy of .003%. The ECO is considerably more stable than the Navy type LM or its Army equivalent BC221, which maintain an accuracy of .01%. For this reason, no additional variable compensating condenser was found necessary, although it had originally been planned to add a small capacity trimmer condenser across the main tuning condenser for screwdriver adjustment from the side of the ECO box. Due to the excellent stability which was obtained, it was also considered unnecessary to incorporate a 100 kc. crystal and associated circuit in the unit.

The range from 3500 to 4000 kc. is well centered, covering from 230 to 2126 on the dial. This represents 996 direct reading dial divisions for the 80-meter band which anyone will agree should be sufficient. Harmonics for either v.f.o. or frequency measuring purposes are usable to at least 30 megacycles, but have not been checked above that point.

One of the tests used in connection with temperature compensation was to fasten a lighted cigarette to a wooden dowel and hold the hot end of the cigarette adjacent to various components within the ECO box, after zero beating the ECO output with another frequency meter, or the station receiver. With the component values as given, it was impossible to obtain any perceptible frequency drift after allowing the ECO to warm up for thirty seconds. Coupling the v.f.o. to the transmitter does not affect the frequency, and in fact direct shorting of the coaxial output terminal makes no change in the pitch of the note that can be detected by ear. Apparently one isolation stage is entirely adequate.

The ECO section should be wired except for C_3, a 6SK7 tube inserted in the socket and 6.3 filament volts placed between the filament lead and the box. Next a 45 volt "B" battery or other high-voltage source should be connected between the HV lead and the box (ground). This procedure is necessary for determining the condenser to be used for C_3 as described below, and the signal may be picked up on the station receiver as precise calibration is unnecessary.



R_1, R_2, R_6—50,000 ohm, ½ w. res.
R_3—1 megohm, ½ w. res.
R_4—220 ohm, 2 w. res.
R_5—100,000 ohm, ½ w. res.
R_7—2000 ohm, 25 w. (5000 ohm with slider) res.
C_1—80 μμfd. midget var. cond. (Hammarlund MC75M)
C_2—150 μμfd. zero temp. coef. ceramic cond. (CRL 814Z)
C_3—20 μμfd. zero temp. coef. ceramic cond. (CRL—See text)
C_4—80 μμfd. neg. temp. coef. ceramic cond.
C_5, C_8, C_{10}, C_{11}, C_{14}—.01 μfd. 400 v. cond.
C_6, C_7, C_9, C_{12}—100 μμfd. mica cond.
C_{13}—.05 μfd. 400 v. cond.
C_{15}, C_{16}—20/20 μfd., 350 v. dual elec. cond. (Sprague—See text)
J_1—Chassis connector
J_2—Single circuit jack
CH_1—16 hy. 50 ma. filter choke (Stancor C1003)
RFC_1—2.5 mhy. choke
RFC_2—30 or 40 mhy. r.f. choke
S_1, S_2—S.p.s.t. bat handle sw.
T_1—275-0-275 v. @ 50 ma., 5 v. @ 2 amp., 6.3 v. @ 2.5 amp. (Thordarson T22R30)
L_1—(See text)
V_1—6SK7 tube
V_2—6F6 tube
V_3—6L7 tube
V_4—5Y3 tube
V_5—VR105 tube

Fig. 1. Complete schematic diagram of dual-purpose frequency meter-v.f.o.

The wiring diagram shows C_3 as 20 μμfd. The CRL ceramic tube zero temperature coefficient condensers are supposed to have a capacity tolerance of ± .5 μμfd. in the low values and ± 2½ per-cent in the higher values. Actually one marked 175 μμfd. was closer to 195 μμfd. For centering the band, since no trimmer condenser is used, it is necessary to determine the condenser to be used for C_3 experimentally before the ECO box is put in place on the chassis. In one case, a condenser marked 20 μμfd. centered

(*Continued on page* 118)

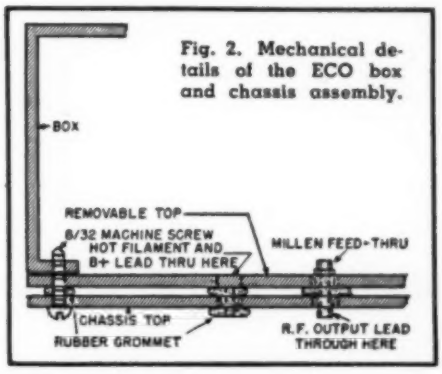
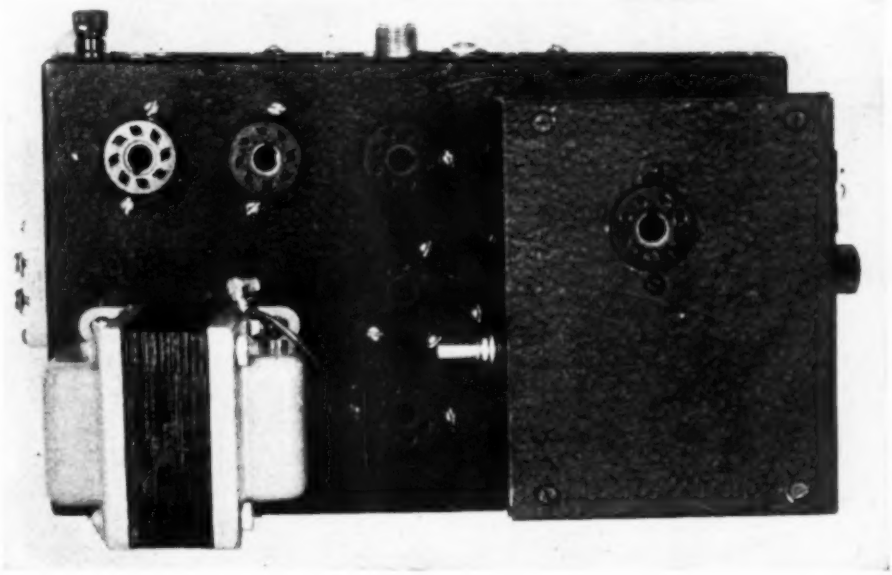
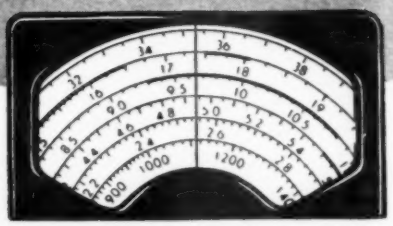


Fig. 2. Mechanical details of the ECO box and chassis assembly.

Top view of the home-built unit. Although it does not appear so in the photograph, the 3x4x5 inch ECO box is centered on the chassis.



International SHORT-WAVE



***Compiled by* KENNETH R. BOORD**

WE ARE pleased to dedicate the May *ISW Department* to radio in the new Dominion of Pakistan.

At present, *Radio Pakistan* has transmitters operating in four of its principal cities—Karachi (national capital), Dacca, Lahore, and Peshawar.

In Karachi there are two m.w. stations—one of low power and one of fairly high output. The low-powered transmitter operates on 1,452 kcs., power unknown; the high-powered one is on 825 kcs. with 10 kw. Presently inactive is 850 kcs. which serves as an alternate for 825 kcs. Karachi's short-wave outlet is listed officially on 6.075 with a power of 250 watts. It radiates the network programs of *Radio Pakistan* originating in Karachi. The alternate short-wave channel is 6.120 (inactive).

Dacca's m.w. outlet is on 1,167 kcs. with 5 kw. power. The present s.w. channel in use is 15.270 with 7.5. kw. power; alternate s.w. frequencies of 11.890, 4.950, and 3.460 are now inactive. The Dacca short-wave station relays the 1,167 m.w. transmitter as well as a few network programs direct from Karachi (chiefly the *English* news).

Lahore is operating currently on m.w. *only*, on 1,086 kcs., 5 kw.; it relays network programs from Karachi as well as originating regional programs from its own studios.

Peshawar, like Karachi, has one low-power and one high-power m.w. transmitter, on 1,500 kcs. and 629 kcs., with 250 watts and 10 kw., respectively; relays network programs and also originates its own regional broadcasts.

In addition, *Radio Pakistan* has a number of m.w. and s.w. stations under construction. These include:

KARACHI—A 7.5 kw. station is under construction with assignment to 3.450 and 4.935; a 20- and a 100-kw. transmitter are "reported" to be under construction, but no frequency assignments have been announced.

PESHAWAR—A 7.5 kw. transmitter is under construction for assignment to 3.320 and 4.790.

LAHORE—A 7.5 kw. job is under construction for assignment to 3.355 and 4.818.

MULTAN—A 7.5 kw. station is under construction for assignment to 3.385 and 4.910; a 5 kw. transmitter, to be assigned to 600 kcs.

Other m.w. outlets, either projected or under construction, include Hyderabad (Sind), 910 kcs., 5 kw.; Bannu, 950 kcs., 1 kw.; Quetta, 1,040 kcs., 10 kw.; Gutrat, 1,055 kcs., 1 kw.; Sialkot, 1,195 kcs., 1 kw.; Sylhet, 1,200 kcs., 1 kw.; Jessore, 1,250 kcs., 1 kw.; Bhawalpur, 580 kcs., 1 kw.; Lyallpur, 675 kcs., 1 kw.; Montgomery, 715 kcs., 1 kw.; Sukkur, 780 kcs., 1 kw.; Chittagong, 795 kcs., 5 kw., and Sheikheura, 825 kcs., 1 kw.

Owner of all the stations is the Pakistan Government with headquarters in Karachi, Sind.

Incidentally, in Lahore, Karachi, and Peshawar the dominant language is Urdu, while for Dacca it is chiefly Bengali.

The most commonly-heard short-wave outlet from Pakistan is *Radio Pakistan*, Dacca, on 15.270, which first started operations on 11.890. It moved to 15.270 on February 13, presumably to escape severe QRM from the *"Voice of America in Manila"* on 11.890.

Dacca's schedule appears to be daily at 2030-2200, 0100-0130, 0140-0230, 0600-1130; news has been heard at 2130, 0730, 1030. Since the day the transmitter moved from 11.890 to 15.270, I have found the 19-m. channel best here in West Virginia around 0730 when news is presented. I have heard location and frequency announced at 0745 just preceding "tonight's announcements" (in *English*). The station usually can be heard here also at 2130 with the news, but in the evening it is much weaker and often has CWQRM. Mornings it is in the clear and normally is quite readable to around 1030 news time when a powerful carrier causes interference. (I believe the QRM is caused by the carrier of WCBN, New York City, during its "warm-up" period at 1030-1115. During that time, *Radio Pakistan, Dacca*, is partly readable here.)

An Indian correspondent tells me that the s.w. transmitter at Dacca was constructed in seven weeks by three engineers and four assistants.

I have not yet received current schedules of other Pakistan stations but I believe they are similar to that of Dacca.

Pearce, England, has received a letter from *Radio Pakistan* in Karachi, stating that its transmitter there is still working on 6.070 (officially listed 6.075), and that the transmissions heard late in 1948 on 6.210 were not from *Radio Pakistan*.

(*Continued on page* 140)

(Note: Unless otherwise indicated, all time is expressed in American EST; add 5 hours for GCT. "News" refers to newscasts in the English language. In order to avoid confusion, the 24 hour clock has been used in designating the times of broadcasts. The hours from midnight until noon are shown as 0000 to 1200 while from 1 p.m. to midnight are shown as 1300 to 2400.)

This attractive and well-equipped Listening Post is that of Jack F. Gardener, Jacksonville, Florida. Jack is American representative of the ISW Club, London.

Build Your Own 10.7 mc. DISCRIMINATOR TRANSFORMER

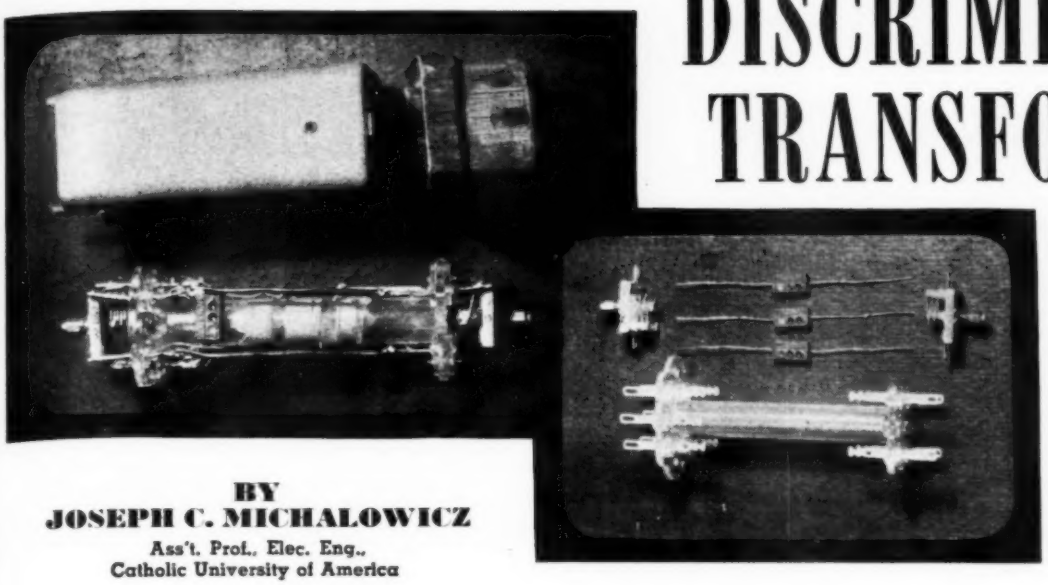


Fig. 1. Parts required to construct discriminator transformer. Photograph shows the fixed and tuning condensers, coil form, shield can, and the completed assembly.

BY
JOSEPH C. MICHALOWICZ
Ass't. Prof., Elec. Eng.,
Catholic University of America

"Learn by doing"— it is not a difficult task to build your own discriminator transformer.

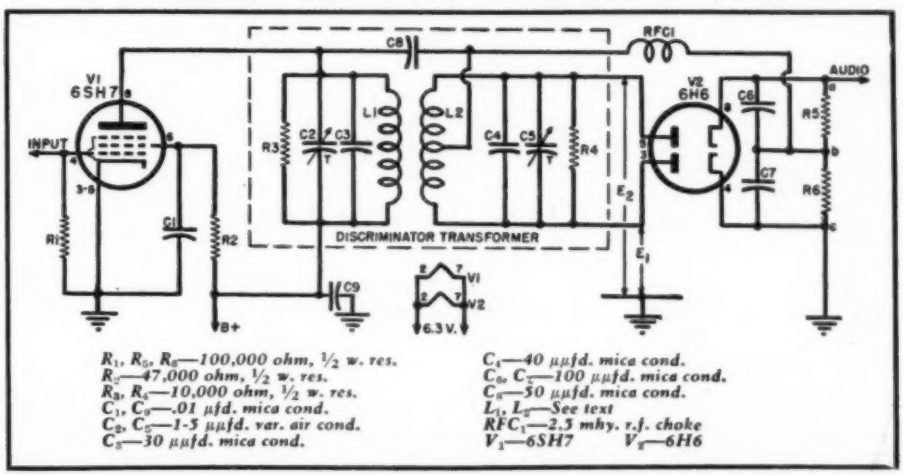
SINCE frequency modulated signals are time axis modulations which are in quadrature with amplitude modulations, customary types of demodulators used in amplitude-modulated receivers cannot be used for separating the intelligence from the modulated carrier current. In the high-frequency and intermediate-frequency networks of an FM receiver, the circuits are very similar to those employed in the customary superheterodyne type of AM receivers, with the principal exception that the networks must accommodate a broader frequency spectrum. (See "New Band FM Receiver," p. 51, RADIO NEWS, April, 1948.) But the second detector in an FM receiver functions much differently from the detector in an AM receiver, it being a special circuit, called a discriminator, that must change the frequency modulation into a variable amplitude signal. It is the most important part of the FM receiver and should be designed and built with much care. It is worthy to note that not only does the discriminator circuit perform its primary function of demodulating the FM signal, but eliminates certain types of static. When a certain abrupt interference enters the i.f. stages of the receiver, a series of spectrum amplitudes of similar polarity, acting simultaneously and symmetrically with respect to the mid-frequency, is produced. Since inputs to a discriminator, consisting of equal simultaneous positive voltages displaced from the mid-frequency, produce zero output voltage, the interference is virtually eliminated in the audio stages of the receiver.

The basic type of discriminator is the balanced discriminator circuit shown in Fig. 2. The 6SH7 tube is the last limiter stage of the receiver and produces a voltage drop across the inductance L_1 which is the primary of the double-tuned transformer L_1-L_2. This transformer is tuned to the i.f. frequency of the receiver, F_c. The secondary of the transformer is center-tapped and the output is supplied through two diode rectifiers to the resistive loads R_3 and R_4. The voltage drops across these two load resistors are in opposition, and if the signal supplied to the discriminator is equally divided between the two diodes, the voltage drop across "a"-"c" will be zero.

The resultant voltages E_1 and E_2, applied to the two diodes, have two components: one supplied through the condenser C_5, and the other inductively through the transformer L_1-L_2. If the input signal is exactly at the i.f. frequency, these two components are displaced by 90° and the resultant voltages E_1 and E_2 have the same magnitude, thus causing a zero voltage drop across "a"-"c." However, should the frequency of the incoming signal deviate in one way or another from the resonant frequency of the discriminator transformer, the displacement angle between the two component voltages will in one case increase and in the other decrease, thus causing a difference in the magnitudes of the resultant voltages supplied to the diodes. This in turn will cause different voltage drops to occur

(*Continued on page* 143)

Fig. 2. Wiring diagram of the discriminator transformer and its associated circuit.



R_1, R_5, R_6—100,000 ohm, ½ w. res.
R_2—47,000 ohm, ½ w. res.
R_3, R_4—10,000 ohm, ½ w. res.
C_1, C_9—.01 μfd. mica cond.
C_2, C_3—1-5 μμfd. var. air cond.
C_5—30 μμfd. mica cond.
C_4—40 μμfd. mica cond.
C_6, C_7—100 μμfd. mica cond.
C_8—50 μμfd. mica cond.
L_1, L_2—See text
RFC_1—2.5 mhy. r.f. choke
V_1—6SH7 V_2—6H6

The Tubeless GRID-DIP Adapter

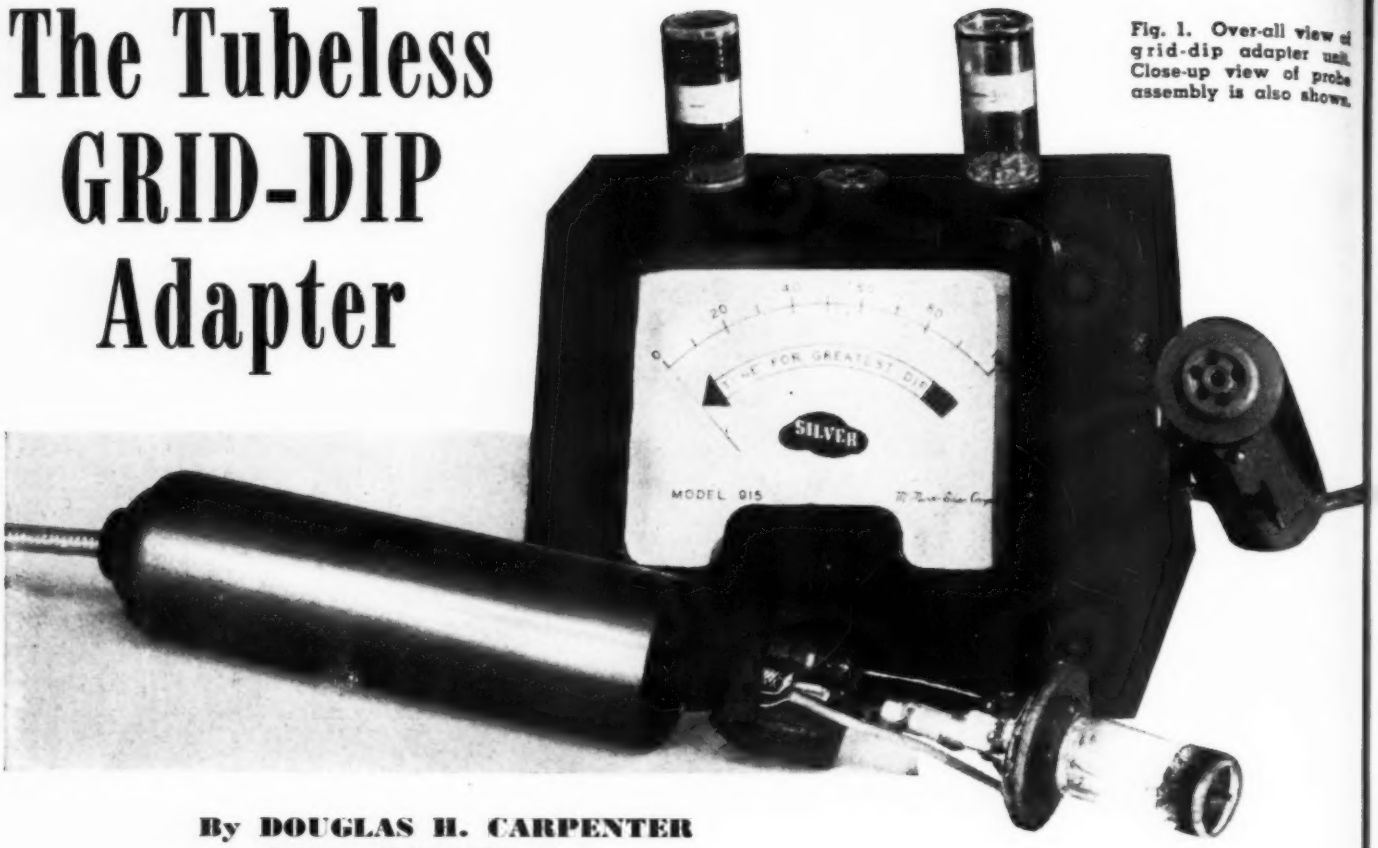


Fig. 1. Over-all view of grid-dip adapter unit. Close-up view of probe assembly is also shown.

By **DOUGLAS H. CARPENTER**
Chief Eng., McMurdo Silver Co., Inc.

This novel unit converts any signal generator or test oscillator to a direct-reading resonance indicator.

THE complex problems encountered by the modern service technician are far removed from those he was required to solve even a few years ago. There has been a gradual transition in servicing technique that identifies itself with the addition of several new and radically different instruments in every progressive radio shop. The new fields of FM and television impose problems that have no counterpart in the average serviceman's experience. The conglomeration of separate instruments required to perform all necessary measurements on present-day equipment represents a considerable initial investment, and is time-consuming from the standpoint that several are needed to analyze even a "run of the mill" service job. Although the unit to be described is designed primarily for the service technician, it has wide application in laboratory, production-testing, and amateur work.

One technique has always been endorsed by technical authorities, and the application of this principle has been followed to the present day. This principle is that of using the signal itself as the medium of determining circuit function. With the advent of high frequency transmission (FM and TV), such a method is no longer practical. Measuring apparatus invariably adds undesired elements to the circuit under test. When dealing with an amplifier that may be detuned by 2 $\mu\mu$fd., the foregoing statement is certainly justified.

Means, therefore, must be devised to circumvent this inadequacy and allow quick, sure checking of this specialized apparatus. The method to be described is ideal, as it allows measurements without direct mechanical coupling. It permits measurement of all but oscillator frequencies, without the circuit's being energized. It makes possible laboratory caliber comparisons in a simple direct-reading form, eliminating tedious, time-consuming figuration. Every practical frequency range is covered, the only limitation being that of the coupling signal source.

As the heading denotes, the instrument under discussion is primarily a resonance indicator of markedly advanced design. Because of the unit's broad application, it is believed that this article should prove of value to every reader, whether engineer, technician, serviceman, or amateur.

Over a period of time, several authors have described and advocated the use of a grid-dip meter. Essentially, the grid-dip meter is nothing more than an oscillator whose grid current can be changed by coupling an external load to the oscillating tank circuit. The amount of loading depends on the degree of coupling and the Q of the external circuit. If we had an i.f. transformer that was tuned to 455 kc., for example, we could check its actual resonance by coupling the grid-dip meter coil field close to this transformer. As the grid-dip oscillator was tuned to the exact frequency of the specimen under test, a pronounced dip would be observed. This is clearly accounted for by the loading effect of the external circuit upon an oscillator, which is inherently a source of extremely poor regulation. By utilizing several coils, it is possible to cover a certain frequency range and determine the resonant frequencies of all tuned circuits, whether they are energized or not. Band-switching is impossible, because of the physical size of the unit. As the higher frequencies are employed, full-scale deflections are difficult to attain, because of the ratio of oscillator efficiency. The physical size of the calibrated dial must be small because of the necessary miniature size of the total unit.

It is this author's opinion that the very valuable grid-dip oscillator never achieved popularity throughout the service profession because of several shortcomings listed above, and also because of its necessary physical size. There is no other single instrument that can perform as many diversified measurements as the grid-dip meter, nor is there a combination of instruments that can perform such measurements as quickly.

The Model 915 "Tubeless Grid-Dip Adapter," in conjunction with a sig-

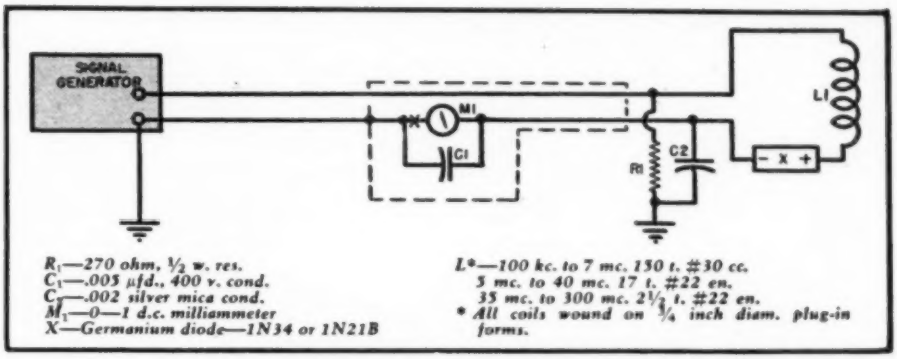
nal generator, duplicates all of the functions of the old grid-dip meter, and does this without undesired complications. The sensitivity is much higher than that of the grid-dip type, thereby allowing greatly expanded utility. It also permits measurement without oscillator detuning.

As the title indicates, this unit is an adapter and is intended to be used with any signal generator or test oscillator. The output of the generator is connected to the adapter by attachment to a screw terminal located in the instrument back plate. If the generator is on and one of the three coils is plugged into the test probe, a full scale meter reading will be observed. The degree of meter deflection is controlled by the output attenuator of the generator itself. The three coils provided cover the continuous range of 100 kc. through 300 mc. The only frequency limitation is that of the companion generator. Since there is usually a large second, third, and fourth harmonic content in the output of any generator on its highest frequency range, the usefulness is proportionally extended.

We have described a little companion unit that multiplies the value of any standard signal generator that the serviceman now has. At this point, it might be appropriate to outline a typical application.

A timely example might be that of an over-all check of a television receiver. With the generator connected to the adapter, plug in the probe coil covering the receiver i.f. range. Switch the generator to the proper range. Adjust the generator output for a comfortable meter deflection. Place the probe close to the last i.f. coil, and tune the generator until a pronounced dip is observed. Tuning the generator either side of the point of greatest dip will allow direct reading of the i.f. selectivity response. This is directly read from the generator dial. In this case, and in all operations, the tolerance, or frequency accuracy, is that of the generator, which is an extreme advantage over former types. The probe is now moved, by the same method, successively to each i.f. transformer, and similar evaluations are made. The r.f. section now can be checked by the same system. During these operations, the television set does not have to be turned on. If it should appear necessary to check the oscillator, the set is turned on and a headset plugged into the jack provided on the unit. When the signal generator is tuned to the same or a submultiple frequency of the TV oscillator, a loud squeal will be heard in the phones. Simultaneously, the meter will kick downward. For r.f. measurement, the proper coil must, of course, be used. Generators having restricted fundamental ranges but usable harmonics work just as well as more expensive types for this application.

It would be impossible to describe all applications of this test unit in the allotted space. Under the following basic classifications have been itemized several of the more important functions that this instrument is capable of performing.



R_1—270 ohm, ½ w. res.
C_1—.005 μfd., 400 v. cond.
C_2—.002 silver mica cond.
M_1—0—1 d.c. milliammeter
X—Germanium diode—1N34 or 1N21B

L*—100 kc. to 7 mc. 150 t. #30 cc.
5 mc. to 40 mc. 17 t. #22 en.
35 mc. to 300 mc. 2½ t. #22 en.
* All coils wound on ¾ inch diam. plug-in forms.

Fig. 2. Complete schematic diagram. Unit covers 100 kc. through 300 mc. A closed circuit jack is inserted at point (X) if audio indications are desired.

Resonance Indicator

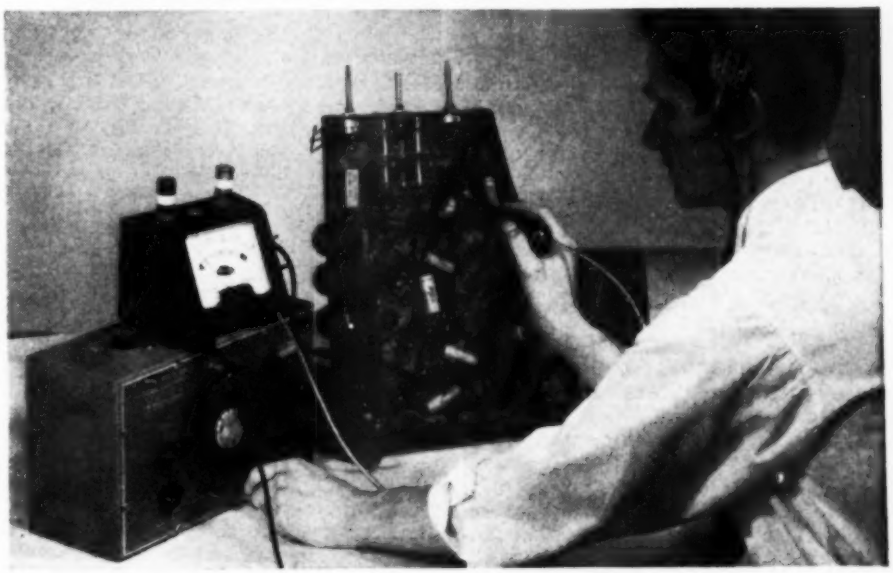
This function is about the most important from an over-all use standpoint. The circuit under measurement does not have to be energized for this type of checking. The adapter unit is utilized as a grid-dip meter, and is coupled to the companion signal generator. Coupling the appropriate probe coil, inductively, to the circuit or specimen under test will permit direct reading resonance indications. Such indication is, of course, the pronounced meter dip as the generator is tuned through the proper frequency. Under this heading would be such measurements as i.f., r.f. alignment, and general checking. Transmitter tuning would be another application. In design work, all tuned circuits can be carefully evaluated and preset. Production checking of coils and tuned circuits in sub-assemblies is also made much faster. Antenna resonance may be quickly determined. Relative *Q* of individual components by comparison is also possible. The photograph below shows a technician using the unit in conjunction with a standard signal generator to make a quick check of a television i.f. strip. Since this adapter will respond only to the proper resonance point, no misleading effects can exist.

Energized Detector

A phone jack is provided so that both audio and visual indications are possible when using the test instrument as an energized detector. The external circuit to be tested may be an oscillator of any type, operating in the aforementioned range of 100 kc. to 300 mc. With the unit connected to the signal generator, plug a headset in the jack provided. When the signal generator is tuned to the fundamental or harmonic frequency of the oscillator, a loud squeal will be heard in the phones. Such a measurement is valuable, as it allows pin-point accuracy when zero beat is reached. To determine where the oscillator should be working, the dip method previously described may be employed prior to this check. Oscillator tracking, output, etc., may be easily analyzed. The probe coil, in this case, may be very loosely coupled to the circuit under test. A complete TV oscillator section may be very quickly set by this meth-

(*Continued on page* 112)

Serviceman illustrates how the grid-dip adapter unit is used in conjunction with a signal generator to check resonant frequency of a television tuned circuit.



Regenerative SHORT-WAVE RECEIVER in Miniature

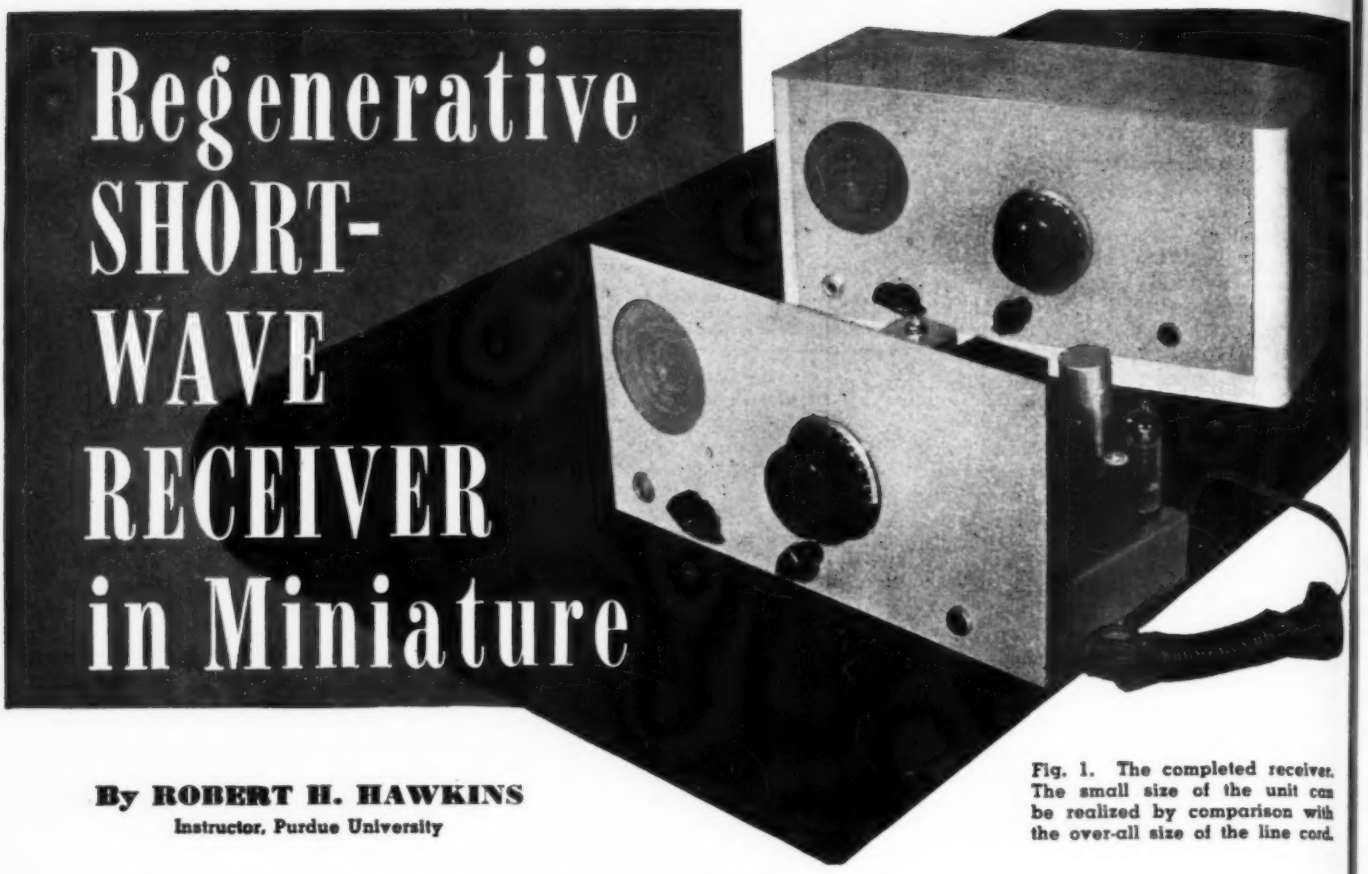


Fig. 1. The completed receiver. The small size of the unit can be realized by comparison with the over-all size of the line cord.

By ROBERT H. HAWKINS
Instructor, Purdue University

Build this low-cost receiver and make DX-ing a pleasure. It covers 5.5 to 18 megacycle band.

A MINIATURE short-wave receiver that would give fine performance was the objective when this unit was designed, and it has more than fulfilled all expectations.

The use of a separate receiver for covering the 5.5 to 18 megacycle band of frequencies was prompted by the need of really great sensitivity and selectivity to cover the 20-meter amateur band. Most two-band home receivers will cover this band of frequencies, but without the sensitivity found in this regenerative receiver. Regeneration was chosen to give the extreme sensitivity desired, and a stage of tuned radio frequency amplification ahead of the regenerative detector gives excellent selectivity. No electrical bandspread arrangement is employed on this unit and hence the entire 20-meter amateur band is covered in about 4 dial divisions. However, this receiver has a vernier dial and little trouble has been experienced in separating the many amateur stations on this band. A 6C4 triode audio amplifier drives the 6AK6 power amplifier to give plenty of gain for loudspeaker operation on most stations. The audio quality is good and the BBC Symphony from London has been received with excellent quality. It is a fortunate fact that the higher-frequency bands are relatively static-free; thus one of the advantages of frequency modulation, freedom from static, is approximated in this receiver. For extremely weak signals, a phone jack is supplied, but the author has found little need for it. Amateur stations as far distant as Jerusalem, Palestine, have been received with amazing clarity.

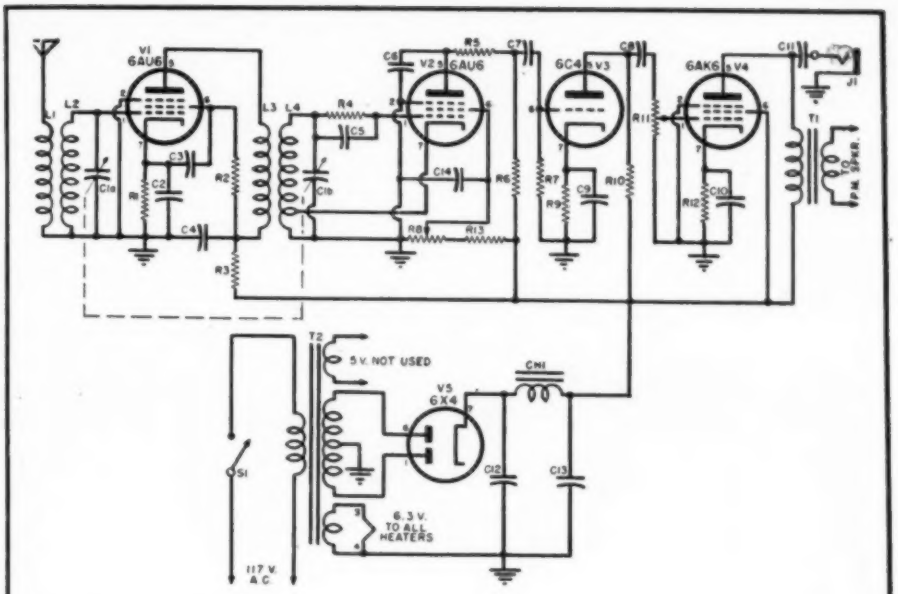
The small size of the receiver makes it an attractive addition to any home. Miniature tubes are used throughout giving excellent performance and filling the small space requirement. Referring to Fig. 1, a photograph of the receiver, the loudspeaker can be seen at the left end of the front panel with the phone jack below it. The bar knob farthest left is the audio gain control with the regeneration control at its right. The vernier-type dial for main tuning is mounted in the center of the panel. The r.f. stage is gang-tuned with the regenerative detector to make for ease of tuning. It was expected that some difficulty would be encountered in trying to make such a combination track over the entire range of frequencies when this unit was first constructed. However, a slight revamping of the number of turns added to the oscillator coil has made for good tracking. The oscillator coil used was a standard *Stanwyck* S-231 and 12 turns of #22 enameled wire were added as shown in the detail drawing (Fig. 5). Two solder terminals are added between those already on the coil to give a total of five terminals—plate, "B plus," grid, oscillator tap, and ground. It is suggested that a coating of wax be added after the new winding and terminals are completed. The antenna coil (*Stanwyck* S-410) is used with no changes and is so placed as to give extremely short leads. The 6AU6 r.f. amplifier not only increases the selectivity of the receiver, but prevents any excessive radiation from the antenna.

To begin construction of this receiver, it is suggested that the following steps be followed. First, study the photographs and circuit diagram until thoroughly familiar with the use and placement of each part. Looking at Fig. 4, the top view of the receiver, let us identify the components. The power transformer is at the upper-left corner of the chassis with the 6X4 rectifier tube and electrolytic filter condenser directly behind it. The two-gang main tuning condenser is in the center of the chassis with the filter choke behind it. Starting at the antenna binding post and working towards the front panel, we find the antenna coil, 6AU6 r.f. amplifier, oscillator coil, 6AU6 regenerative detector, in that order. Starting at the panel in the next row, we find the 6C4 audio amplifier, 6AK6 power amplifier, and audio output transformer. The output leads of the transformer are connected to a Jones terminal strip and thence to the voice coil of the loudspeaker. The parts list should be checked against the photographs to make certain that no parts are omitted or misplaced. Second, lay out a full-size template of the chassis and front panel and then fasten with

"Scotch" tape to chassis and panel for center punching and drilling. Leave the templates on the parts while drilling as it prevents errors in hole sizes which could ruin the chassis. As long as the templates are correct, then the chassis and panel will be correctly drilled. Third, mount all parts before attempting any wiring and make certain that the tube sockets are mounted so as to give the shortest possible leads. The antenna and oscillator coils should also be mounted to give short leads without any crossovers inside the shield can. A suggestion that will ease the job of wiring is that of removing the 0.5 megohm potentiometer and switch until the regenerative detector is wired. After the wiring on that particular tube socket is completed, the potentiometer can be placed in position.

The wiring job on the receiver can be simplified by duplicating the wiring shown in the bottom view photograph of the receiver. In Fig. 3, the bottom view, a paper condenser can be seen mounted on the outside of the left end of the chassis. This condenser is C_{11} which connects to the phone jack. Start with the leads coming out of the secondary of the power transformer and commence wiring the power supply. It will be noted that several insulated solder terminals are placed in the chassis to make for ease of connecting the different circuits. Solder the 6.3 volt filament leads to pins 3 and 4 of every tube, then place all the paper condensers in their proper positions. The resistors and mica condensers are placed in position last, but of course, follow the suggestion of wiring the regenerative detector completely before placing the 0.5 megohm regeneration control in its proper place on the chassis.

In selecting parts for the receiver, remember that a good deal of effort will be spent in constructing it, and a faulty component can cause all sorts of difficulties. Using quality components will be a good insurance of long life and good operation. The main tuning dial used in the original unit was removed from a war surplus tuning unit TU-5B and was slightly revamped. A *National* Velvet-Vernier dial will fill the bill exactly for this



R_1—68 ohm ½ w. res.
R_2—150,000 ohm ½ w. res.
R_3—10,000 ohm ½ w. res.
R_4—1 megohm ½ w. res.
R_5—25,000 ohm ½ w. res.
R_6, R_7—220,000 ohm ½ w. res.
R_8—100,000 ohm pot. (with S_1)
R_9—3000 ohm ½ w. res.
R_{10}, R_{12}—100,000 ohm ½ w. res.
R_{11}—500,000 ohm pot.
R_{13}—600 ohm ½ w. res.
C_{1a}, C_{1b}—365 μμfd. 2-gang var. cond.
C_2, C_3, C_4—.0025 μfd. mica cond.
C_5—100 μμfd. mica cond.
C_6—250 μμfd. mica cond.
C_7—.005 μfd., 400 v. cond.
C_8—.006 μfd., 400 v. cond.
C_9, C_{10}—10 μfd., 25 v. elec. cond.
C_{11}—.02 μfd. 400 v. cond.
C_{12}, C_{13}—15/15 μfd. 450 v. dual elec. cond.
C_{14}—.5 μfd. 400 v. cond.
L_1, L_2—5.5—18 mc. antenna coil (Stanwyck S-410)
L_3, L_4—5.5—18 mc. oscillator coil (Stanwyck S-231, see text)
J_1—Open circuit phone jack
CH_1—8 hy., 85 ma. filter choke
T_1—Output transformer, 10,000 ohm to v.c.
T_2—Power transformer, 315-0-315 v. @ 70 ma., 5 v. @ 3 amps., 6.3 v. @ 3.5 amps. (Stancor P-6120)
S_1—S.p.s.t. sw. mounted on R_8
Speaker—3" PM (was used)
V_1, V_2—6AU6 tube
V_3—6C4 tube
V_4—6AK6 tube V_5—6X4 tube

Fig. 2. Complete schematic diagram of the a.c. operated regenerative receiver.

receiver if one is available; however, the entire tuning unit mentioned above can be purchased on war surplus for about $3.00. The crackle finish shown on the front panel was sprayed on in two coats and baked in an oven. It might be suggested that those having some woodworking experience could easily build a cabinet that would harmonize with period furniture.

Alignment and test of the receiver can be completed in a short time using a standard signal generator and an output meter. Simply inject a signal of 5.5 megacycles into the antenna binding post and adjust the permeability-tuned antenna coil and oscillator coil until maximum signal is indicated at the speaker terminals by the output meter. Then set the signal generator at 18 megacycles, tune the receiver to the high-frequency end of the dial and make any minor adjustments necessary to again give maximum signal indication.

The original unit locates the 20-meter amateur band at about 70 on the 0-100 dial scale. Regeneration control is smooth and the gain control is usually set about half way towards maximum position. A few pointers on how to tune a regenerative receiver may be in order. After the set has

(*Continued on page* 106)

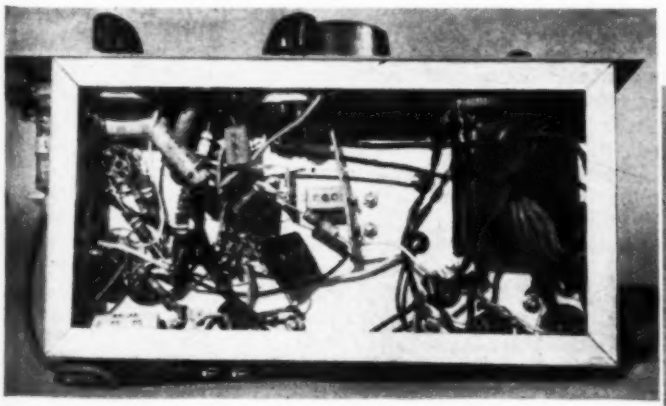
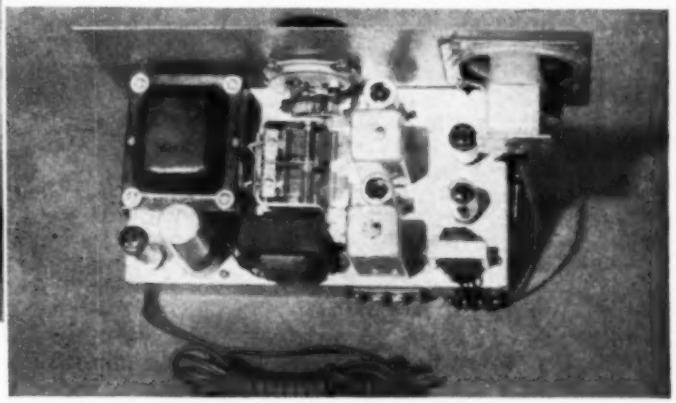


Fig. 3. Bottom view of receiver showing under-chassis components. An exact duplication of parts layout is not necessary.

Fig. 4. Top view of receiver showing correct placement of components. Vernier dial used was a revamped surplus unit.



Present-day television receivers that are designed around an Intercarrier sound system. There are many other TV receivers on the market today that employ the same system.

Modern TELEVISION RECEIVERS

By
MILTON S. KIVER

Part 14. A complete analysis of the design and operation of Intercarrier TV sound systems.

TO THIS point we have been studying what might conveniently be called the conventional television receiver. In this receiver, shown in Fig. 1, the audio and video signals, after passage through a mixer, are reduced to their i.f. values. At some point after the mixer and before the video second detector, the sound i.f. signal is removed from the video i.f. system and fed to a separate set of i.f. amplifiers which are peaked to the sound i.f. value. After two or three i.f. stages, the audio signal is fed to an FM detector where it is converted to audio frequencies. This is then followed by one or more stages of audio amplification after which the signal is powerful enough to drive a loudspeaker. Once the two signals have been separated, every precaution is taken in the video system to prevent any sound voltage from reaching the video detector and the subsequent cathode-ray tube. Usually these precautions consist of one or more trap circuits distributed throughout the video system following the point of signal separation.

While this system will operate successfully when properly designed, it does possess several disadvantages when cost becomes an important design factor. Thus, one of the most important stages in the television receiver, the local oscillator, is also one of its weakest points. We know that the sound i.f. value is the difference between the frequency of the local oscillator and the frequency-modulated sound carrier. If the frequency of the local oscillator should drift, either during the warm-up period when the set is first turned on, or during the operation of the receiver, then the difference frequency produced as a result of the mixing in the mixer will change, too. Thus, consider the case of a television receiver tuned to channel 3 and designed for a sound i.f. of 21.25 mc. On channel 3, the audio carrier frequency is 65.75 mc. and since the oscillator frequency is above this by an amount equal to the sound i.f., the oscillator frequency will be 65.75 mc. plus 21.25 mc., or 87.00 mc. The sound carrier is frequency-modulated, and the modulation shifts the audio carrier frequency plus and minus 25 kc. In other words, the total audio signal for channel 3 can be expressed as 65.75 mc. plus or minus 25 kc.

In the sound i.f. system (including the input discriminator coil), the band pass is about 200-300 kc., although generally the discriminator response is linear only for about 150 kc. If the local oscillator should drift by as little as 75 kc., it is possible for the sound i.f. signal to shift to a non-linear portion of the discriminator characteristic, thereby causing audio distortion. Now, a drift in frequency of 75 kc. with the oscillator functioning at 87 mc., represents a change of less than .09%; at 200 mc., the same frequency drift represents a change of .03%. Using ordinary components, combined with the station selector rotary switches, it can hardly be expected that the local oscillator will not drift more than this during warm-up and even during subsequent operation. It is due to this very situation that oscillators are provided with *fine-tuning* controls which, extended to the front panel, permit the observer to correct

for oscillator drift. While such controls remedy the drifting temporarily, it is annoying to have to use this control several times during each set operation. Furthermore, the oscillator frequency is extremely sensitive to tube capacitance and it is not uncommon to find that the oscillator frequency is altered sufficiently by a tube change to require a complete realignment of the oscillator circuit. Finally, in time, the resistive and capacitive components themselves will change sufficiently in value, even without a tube change, to also require a complete realignment.

The local oscillator is the source of other annoyances. Any inadequate filtering of the "B+" voltage used by the local oscillator will cause the oscillator frequency to vary at a 60-cycle or 120-cycle rate. This results in phase and frequency modulation of the local oscillator, which passes through the sound i.f. system and FM detector and appears as an audible hum. The only remedy for this is complete filtering of the power supply. We also obtain phase and frequency modulation when acoustic feedback from the speaker causes oscillator coils, condensers, and tube elements to vibrate. Vibrations of the cores in permeability or slug-tuned coils or the plates in a condenser can be a difficult annoyance to eliminate.

Solutions to all of the foregoing problems are not unknown, but they usually involve sufficient additional expense to make them unattractive in today's competitive market. Manufacturers are constantly on the alert for methods of decreasing the cost of television receivers and the recently devised Intercarrier television sound system appears to offer economic advantages, as well as the elimination of the effects of oscillator drift.

Basic Principles of Intercarrier System

In sets employing the Intercarrier system, the sequence of stages follows the form shown in Fig. 2. A quick comparison of this illustration with that of Fig. 1 reveals that separation of the audio and video signals does not occur until both signals have passed through the video second detector and the video-frequency amplifiers. Thus, at first glance, every precaution which was previously taken to insure that the sound voltage did not reach the cathode-ray tube is now seemingly ignored. Another fact which appears contrary to previous principles is the passage of the FM signal through the AM video detector where the possibility of slope detection exists. We thus appear to have here an unworkable combination used as the basis for the Intercarrier system.

From the block diagram, Fig. 2, it is seen that the audio and video signals are received by the r.f. stages of the receiver, lowered in frequency at the mixer by beating with the local oscillator voltage, and then both passed together through a common video i.f. system.

The carrier i.f. values after passage through the mixer are the same as they would be using the conventional system of Fig. 1. The intermediate frequencies assigned to each carrier are functions only of the local oscillator setting and to this point in the receiver both systems are identical. The first departure appears in the i.f. system. The video i.f. response characteristic for a conventional receiver is indicated by the solid line in Fig. 3. To adapt

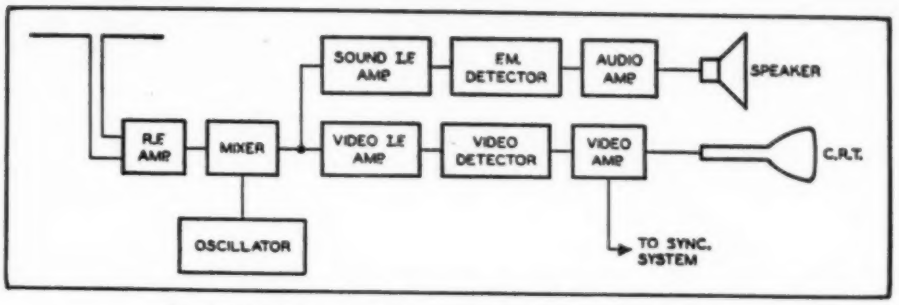


Fig. 1. Block diagram of a conventional television receiver.

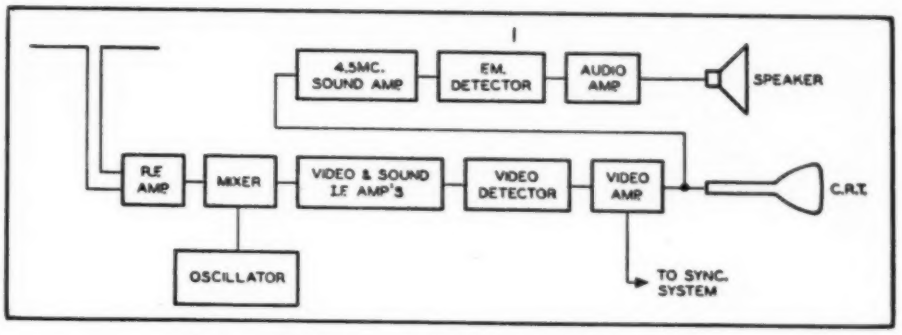


Fig. 2. Block diagram of an Intercarrier TV receiver.

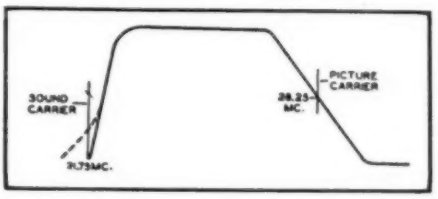


Fig. 3. The solid line represents the desired i.f. response of conventional TV receivers. The dotted line shows the modification required for sets operating on the Intercarrier system. With this change the response becomes more symmetrical.

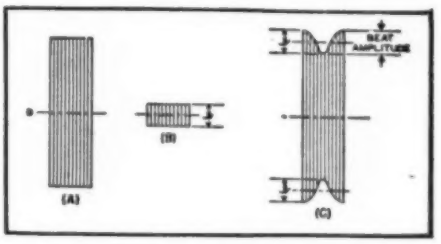


Fig. 4. When two signals beat together, the resultant voltage will contain a beat frequency equal to the frequency difference of the two signals.

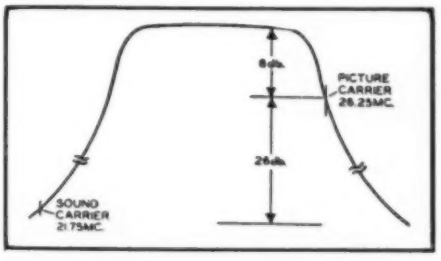
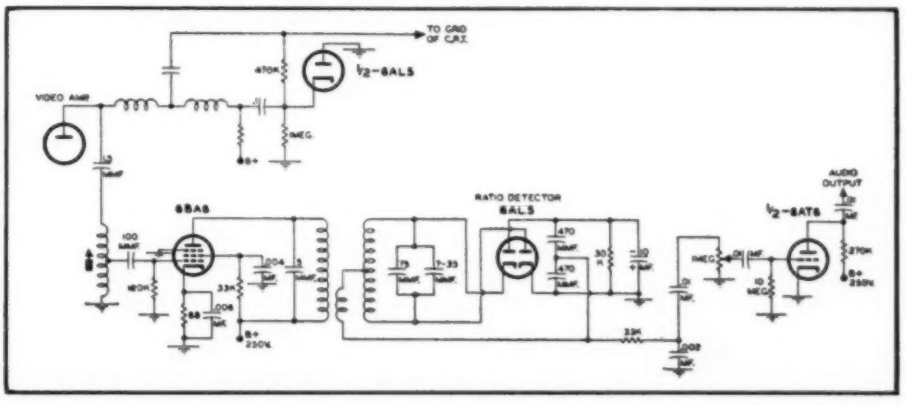
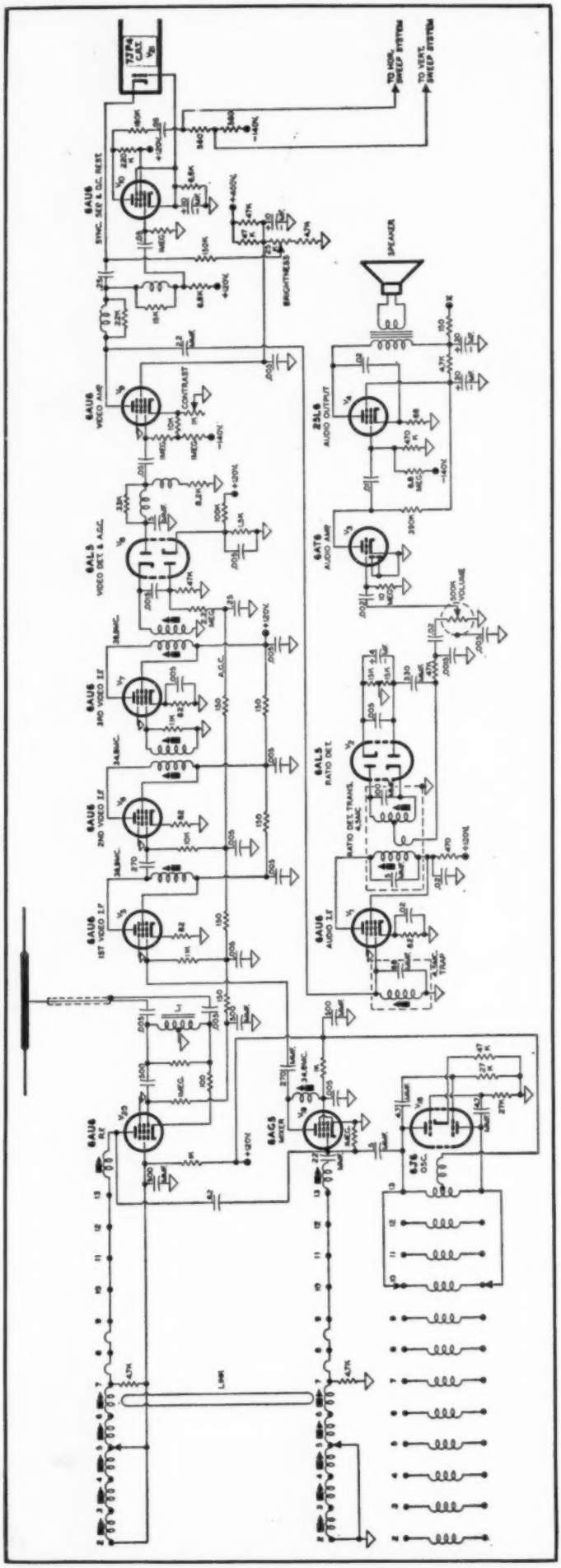


Fig. 5. The i.f. response curve recommended for television receivers employing the Intercarrier system.

Fig. 6. A series resonant trap connected from plate to ground is used to remove the 4.5 mc. voltage from the video system and feed it to the audio system.





this response for the Intercarrier sound system, it must be widened to include the sound i.f. signal, as indicated by the dotted line. However, instead of providing the sound carrier with as much amplification as the video signal receives, we provide it with considerably less amplification, and it is specifically because the sound carrier receives this lesser amount of amplification that the system is able to function. This is important, for if the level of the sound carrier is not kept considerably below the level of the video signal, the latter signal becomes completely unusable.

To understand why the sound carrier level must be considerably below the video signal level, let us look ahead in Fig. 2 to the video detector. The video and sound i.f. signals reach this point in the Intercarrier system after passage through the i.f. system. Now, a detector (such as used ordinarily for the video second detector) operates basically in the same manner as the previous mixer. In both, a mixing process occurs. Thus, in the mixer stage (which has long been known as the first detector), the local oscillator voltage beats with the incoming signal or signals to produce the i.f. signal. At the video second detector, a beating or mixing takes place between the video and sound i.f. carriers with the result that a 4.5 mc. beat note is produced. In this case we could consider the video carrier as being equivalent to the local oscillator and the audio carrier as the incoming signal. The result of the mixing is a 4.5 mc. beat note. In addition to the beat note, we also obtain all of the 0—4 mc. video frequencies from the video carrier.

The reason for keeping the level of the sound carrier low can now be given. Consider the two carriers shown in Fig. 4, A and B. Assume the larger one to be the video carrier and the smaller one to be the audio carrier. If these two signals are mixed together, a ripple will be produced in the resultant wave, Fig. 4C, which will have a frequency equal to the difference between the carrier frequencies. In this case this is 4.5 mc. As long as the *amplitudes* of the two carriers differ considerably, the amplitude of the 4.5 mc. beat note will remain small and unaffected by any amplitude modulation contained in the video carrier. Here is one of the pivotal points in the Intercarrier television sound system. *By maintaining the sound carrier small in comparison to the video signal, we obtain a 4.5 mc. beat note which contains only the frequency modulation of the original sound r.f. carrier and practically none of the video modulation.*

The sound carrier is continually shifting back and forth between the limits of plus and minus 25 kc. In the mixing process in the video second detector this frequency modulation is inparted by the sound i.f. carrier to the 4.5 mc. beat note. The 4.5 mc. signal represents the difference between the video and sound i.f. carriers. The frequency of the video carrier is fixed, but the frequency of the sound carrier continually shifts back and forth. This changes the value of the beat note. Thus, while we speak of 4.5 mc. as the beat note, we actually mean a beat note with a center frequency of 4.5 mc., but which shifts back and forth about this value to the limits of plus and minus 25 kc. This frequency shifting, remember, represents the sound intelligence of the television broadcast.

Now let us see how the foregoing is employed to make the Intercarrier television sound system workable. When the video carrier (with its amplitude modulation) and the audio carrier are received at the receiver, they have substantially the same amplitude. (The FCC regulations state that the power of the sound carrier be 50 to 150 percent of the power of the video carrier when transmitting synchronizing pulses. However, most stations transmit equal sound and maximum amplitude video carriers.) After passage through the mixer stage, the two signals are converted to their i.f. values and are ready to pass through the i.f. system. If we are to keep the degree of amplitude modulation of the beat note signal to a minimum, it is desirable to keep the level of the sound carrier at least 26 db. below the peak video carrier level at the

(*Continued on page* 100)

Fig. 7. A portion of the Tele-Tone 7-inch television receiver, which operates on the Intercarrier principle.

HAMS—

You Still Have Time To Enter The . . .

RADIO & TELEVISION NEWS

$10,000.00

NEW HAM CONTEST

★ ***Closing date extended to March 1, 1950***

★ ***Choice of U.S. Savings Bonds or Amateur Radio Equipment***

IN ANSWER to many requests and in recognition of the fact that much valuable training time is lost during the vacation period, the judges have decided to advance the closing date of the contest to March 1, 1950. Original closing date was December 31, 1949.

The issuing of new licenses and call letters by the FCC following the successful passing of the amateur radio license examinations sometimes takes as long as six weeks. The new closing date, therefore, will allow sufficient time for this processing to all those passing their exams prior to January 1, 1950, or even later. The two months following should find all new licensees, trained during the contest period, in possession of their coveted tickets. The contestant (trainer) will then have sufficient time to send us the dates and call letters shown on the new licenses of those trained during the contest period.

Contestants will, on or before March 1, 1950, send us the call letters and issuance dates of licenses of the new hams trained by themselves during the contest. These will be checked by the judges from the FCC lists sent to the publishers of the Radio Amateur Callbook as of March 1, 1950.

U. S. Savings Bonds, if preferred by winners, will be awarded instead of equipment.

Don't underestimate your chance to win. Early entries are mostly from small towns and cities. Hams in our large metropolitan centers are getting off to a slow start. There's plenty of opportunity and time to "hit the jackpot!"

We know that we are all going to win additional prestige and security for our hobby.

That's worth much more than we hams can buy at any price.

How about *you* OM? Can Amateur Radio count on *you* to do your share?

Send in your entry NOW! Don't wait. Remember the new ham can give credit only to one individual or club as his trainer. It's to your advantage as a contestant to list your trainee on your entry blank promptly and send it in.

Remember "Amateur Radio Needs New Blood"

A TV ANTENNA ORIENTATION

By FRED MARCO
Consulting Engineer

This novel yet simple test instrument permits a service technician to install a TV antenna without additional help.

Service technician orientating an antenna using this easy-to-build instrument.

THE proper location and orientation of the TV receiving antenna has always been a major problem to the installation men and service organizations engaged in this type of work. Placing the receiver itself in a room location pleasing to the critical housewife, running the transmission line to the roof, and instructing the customer in the proper operation of the controls is a relatively simple and straightforward procedure, but getting the antenna in the best roof spot and orienting it for the maximum input to the receiver, with a minimum of "ghosts," has been a job requiring good judgment, much tinkering, and a lot of luck.

It has been almost impossible for one man, working alone, to effect the best compromise, unless possessed with infinite patience, lots of time, and energy enough to repeatedly run back and forth from the roof to the receiver, to actually see on the screen the result of a few feet movement or a few degrees rotation of the antenna. Although TV engineers and servicemen have been known to get their necks out pretty far, no one yet has achieved the ostrich-like length necessary to stand on the roof, rotate the antenna, and at the same time, watch the TV screen image.

In order to do a good job in a minimum amount of time, standard procedure among the better installation houses has been to send *two* men on a job, one of whom stays at the receiver and relays instructions to the roof man, by intercommunicating phones or by sheer lung power. While this method undoubtedly works to a reasonable degree, it is wasteful of manpower and time and also leaves a good deal to the judgment of the downstairs operator.

Now, if the man on the roof could see for himself the result of his adjustments, the maximum effect could be achieved in the minimum time, with complete assurance of peak performance. Since it would be a bit awkward to carry the receiver itself up to the roof, the logical method is the use of an indication device, small, light in weight, easy to read, and low in cost, which can be connected to the receiver and carried to the roof, and which visually interprets the quantity that mainly interests us, the brightness of the received image.

The instrument to be described does exactly this and is known as the *Simpson* TV Antenna Compass.

How To Use It

Actual use of the equipment is simple and straightforward. On a new installation, the receiver is first connected, turned on, and allowed to warm up thoroughly. Meanwhile the transmission line is installed and the antenna set up temporarily in what appears a likely roof location, and oriented approximately to the direction of the transmitting station. Now, returning to the receiver, the two test clips associated with the junction box are connected to the set. One of these clips is conventional and furnishes the ground return, being merely connected to the chassis at a convenient point. The other clip, the "high" side, is of a special alligator type, having a needle point associated with the jaws in such a manner that the point pierces the insulation of any wire to which it may be attached, thus furnishing contact without the necessity of scraping insulation or finding an exposed terminal. This "high" clip must be attached to the modulated electrode of the picture tube, which in most receivers is the control grid. Some receiver designs put the control grid at ground (r.f.), and drive the cathode. In these cases the "high" clip should be connected to the cathode. The proper lead is readily apparent to the serviceman by inspection of the wiring diagram of the particular receiver being used. See Fig. 1A and Fig. 1B. Since all TV receivers must allow the base of the picture tube to float, the socket is wired to the chassis with flexible, insulated leads, and, therefore, this connection can always be easily made. It may not even be necessary to remove the metallic safety screen on the back of the receiver, since this high lead is usually long enough and has enough slack to be fished through the ventilation holes in the back, thus allowing the inch or so necessary for connection.

Now, with the two clips of the probe properly connected, the meter is plugged into the short extension fitting on the other end of the probe, and a station tuned in. If the receiver has a fine tuning control, this should be adjusted in the conventional manner, and then the contrast (video gain) control, adjusted for approximately half-scale meter reading. The meter itself has a "Hi-Lo" switch to reduce its sen-

LOCATION-AND-INDICATOR

sitivity if necessary, and this should be in the "Hi" position during these preliminary adjustments. The channel selected should be that of the station expected to be weakest and most critical at the receiving location. It will be noted that the meter reading will vary with the setting of the gain control and also will vary somewhat with the fine tuning control. Also, if the receiver is still "drifting," due to warm-up, the meter reading will also drift slightly. Therefore, all antenna adjustments must be made with the receiver operating at constant gain and tuning, in order to be relative and capable of later duplication, if desired. Leaving the probe connected, the meter itself is disconnected, and a length of ordinary two-wire extension cord, long enough to reach to the antenna, is substituted. Proceeding to the roof, with the meter and the other end of the extension cord, the meter is again plugged in, and will read the same as it did at the receiver. Since the fittings on the probe and meter are standard 115 volt household plug and socket, any ordinary extension cord can be used for this purpose, since the lead carries only a small amount of current at low d.c. potential. There is no a.c. or r.f. in the extension line and, therefore, it need not be special. No precautions need be observed other than to keep the cord a few feet away from the antenna lead-in.

With the meter on the roof, the antenna can be moved a few feet in different directions and rotated for maximum scale indication, with complete assurance that this maximum also coincides with the maximum input to the receiver and, therefore, maximum screen image brightness. It's just as simple as that!

If the original temporary situation of the antenna turns out to have been a poor one, the meter may actually go off-scale when a "hot" spot is found. By snapping the "Hi-Lo" switch to the "Lo" position, thus reducing the sensitivity of the meter, a trip to the receiver to reduce the gain is avoided. It is surprising how quickly and accurately the best antenna position and orientation can be found, taking all guess-work and personal judgment out of the argument. The actual adjustment of the antenna takes only a few moments.

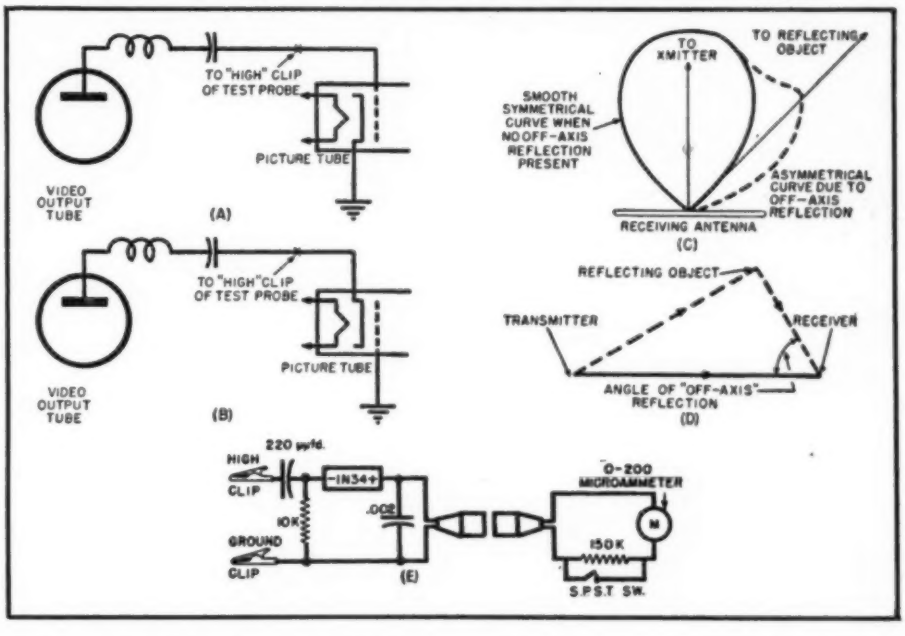
With this optimum adjustment of the antenna for what was assumed to be the weakest station, it will be generally found that all other stations, when tuned in at the receiver, will give an even higher scale reading on the instrument, when returning to the receiver and re-checking. If this is found not to be the case, due to erroneous choice of the test channel, the procedure can be repeated, although this is seldom necessary. By comparing maximum meter readings between various stations, a relative idea of their input to the receiver may be had, although this is not necessarily a direct indication of their field strength, since the antenna itself (and the receiver), may be working more effectively on one channel than on another. A ready means of comparing various antenna designs is also available by the use of this instrument, since an actual meter-reading comparison can be made, rather than trusting to personal opinion.

All of the above assumes a constant transmitted signal from the station and a constant gain in the receiver itself. Therefore, it is important that any actual quantitative work be done only while a test pattern is being received, since varying picture content will naturally give varying meter readings. (The meter reading is proportional to the picture modulation and not to the video carrier.) Also, changing the setting of the gain control or abnormal drifting of the receiver will give non-comparable indications. The reasons for this are quite obvious.

It should also be mentioned that if the receiver has automatic gain control (a.g.c.) in the video channel, this

(*Continued on page* 136)

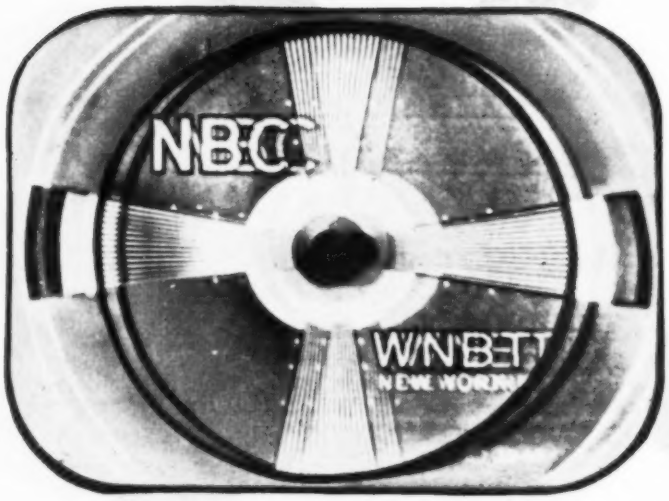
Fig. 1. (A) Illustrating where the "high" clip terminal of test probe is connected in a typical grid drive TV receiver, such as the Crosley 9-408. (B) "High" clip. terminal connection in a typical cathode drive TV receiver, such as the Admiral 19A series. (C) Distortion of symmetry due to off-axis reflection. (D) Off-axis reflection. (E) Complete wiring diagram of the television antenna compass.



The peaking of r.f. and oscillator sections in a TV receiver can be done on the bench, using this easy-to-build test unit.

The TV antenna compass and probe assembly. This is all the equipment necessary to orientate your TV antenna.

TV ghosts are usually considered the result of signal reflections—but there are other factors that can bring about identical ghost images.



Typical ghost as seen on kinescope screen. This can be caused by multi-path reception, line mismatch, or improper receiver adjustment.

Elimination of Reflections on Video Lines

By
C. A. MEYER and R. G. MIDDLETON
Tube Dept., Radio Corporation of America

TELEVISION "ghosts" may arise from several causes. One type of ghost is caused by reception of two or more signals from the same transmitting station. The desired signal travels, in most cases, by direct line-of-sight, while the undesired signal is reflected and delayed along its course. Reflection can take place from buildings, cliffs, suspension bridges, or other large structures, man-made or natural. The reflected signal is delayed with respect to the line-of-sight signal because it travels a longer path, and thereby causes a displaced or ghost image on the television screen.

A second type of ghost is caused by a mismatch of the television line to the receiver input circuit. When the impedances of the line and the receiver input circuit differ, not all of the available signal energy is delivered to the receiver. Instead, a portion of the incoming energy is reflected from the receiver back up the line to the antenna. This diverted energy is usually re-reflected from the antenna terminals back down the line to the receiver, where it causes a displaced secondary image or ghost. When the mismatch between the receiver and the line is very bad, several ghosts can be observed because the signal "bounces" back and forth several times along the transmission line between the antenna and the receiver.

A third type of ghost can result from impaired receiver operation when the video intermediate-frequency amplifier or video amplifier is improperly adjusted. This type of ghost, however, is infrequent.

The first type can be minimized or eliminated, in many cases, by suitable orientation and positioning of a directional antenna. In poor receiving locations, however, it may be impossible to attenuate this type of ghost signal to a level where it is unobjectionable. No other method as yet is commercially available which can eliminate ghosts in such situations.

This article is primarily concerned with the elimination of the second type of ghost: that caused by a mismatch between the transmission line and the receiver input circuit. It should be observed that while a line can be practically matched to a receiver for operation on all television channels, it is not possible to match a line to an antenna over a wide band of frequencies. Hence, a match is sought only at the receiver input terminals. Fortunately, a match at this point suffices for satisfactory, ghost-free reception.

Mismatch arises in practice from several situations. In the case of older installations, consideration may not have been given to matching requirements, and a line may have been used which has a widely different impedance from the impedance of the receiver input circuit. When an old television receiver is traded in on a new receiver, the customer usually fails to consider possible differences in receiver input systems. In some cases, coaxial lines are installed on the assumption that they will help minimize severe noise pickup at street level; but, since coaxial lines have a considerably lower characteristic impedance than that of many standard receivers, a mismatch may be encountered. In other cases, the line is selected to "match" the antenna impedance instead of the receiver impedance. This selection, however, is based upon incorrect conceptions and frequently leads to reflections along the line.

Determination of Source of Ghost

When ghosts are observed on the kinescope screen, it becomes necessary at the outset to distinguish between displaced images caused by multi-path reception, and those caused by line mismatch. These two types of ghosts can frequently be distinguished by switching the television receiver from one station to another. If ghosts are observed on one channel, but not on the other channels, multi-path reception is indicated.

If a reflecting surface is so situated that multi-path reception could be expected from all stations, the switching test will be inconclusive. In such a case, or if only one television station can be received at the time, the chart shown in Fig. 1 usually suffices to distinguish between ghosts caused by multi-path reception and those caused by line mismatch.

The chart is further useful because the switching test may be inconclusive even if more than one station is available. To obtain a mismatch ghost, a mismatch condition must exist at both

antenna and receiver. Usually, in one channel, the antenna will practically match the line, although a mismatch exists in all other channels. Accordingly, a switching test might lead to the erroneous conclusion that a multi-path ghost is present, when, as a matter of fact, line reflection is taking place. Reference to the chart, however, will answer the question conclusively.

The displacement of a ghost image on a kinescope screen depends on the horizontal sweep width and upon the time delay between desired and undesired signals. This time delay has a definite relation to line length in the case of mismatch reflection, and a definite relation to path-length difference in the case of multi-path reception. In the case of line mismatch, the duration of the delay also depends upon the type of line used.

Because a multi-path ghost is considerably more displaced than a mismatch ghost (unless an unusually long line is used), differentiation is possible upon this basis. Furthermore, when a mismatch ghost is present, its displacement on the kinescope screen will check closely with the value found from Fig. 1 with respect to horizontal sweep width, type of line, and line length.

To use this chart, adjust the horizontal sweep width to correspond with the nearest value given in Fig. 1; measure the amount of displacement (leading edge of main image to leading edge of first ghost); and determine or estimate the length of the antenna transmission line. Find the displacement (D) on the vertical axis of Fig. 1 and the line length (L) on the horizontal axis. If the intersection of these two coordinates is approximately on the diagonal for the sweep width and type of transmission line used, then one may reasonably assume that the ghost is caused by a mismatch.

Let us take the following example: A displacement of 0.15 inch is observed on a 10BP4 10-inch kinescope; the sweep width is 8 inches; approximately 325 feet of RG-58/U coaxial cable connects the receiver to the antenna. Since L and D nearly intersect on the RG-58/U line for a 10-inch tube, the conclusion is drawn that the ghost is caused by mismatch. If the line is short and displacement of the ghost image is very small, it may not be possible to measure this displacement on the screen. The effect in this case is that of "fuzziness" or loss of definition and detail.

Matching Considerations

Representative impedances for both receiver and line are shown in Table 1. It is evident that mismatch difficulties may arise from installation of unsuitable lines, changing receivers, or mixing balanced and unbalanced systems. Television receivers have either balanced or unbalanced input systems, as diagrammed in Fig. 3. The unbalanced input system requires a coaxial line for proper operation; the balanced input requires a twin line (shielded or unshielded). A pair of coaxial lines, or a shielded balanced line provides a shielded balanced input. A twin-lead line provides an unshielded and balanced input.

Receivers with balanced input systems should be operated from bal-

(A)

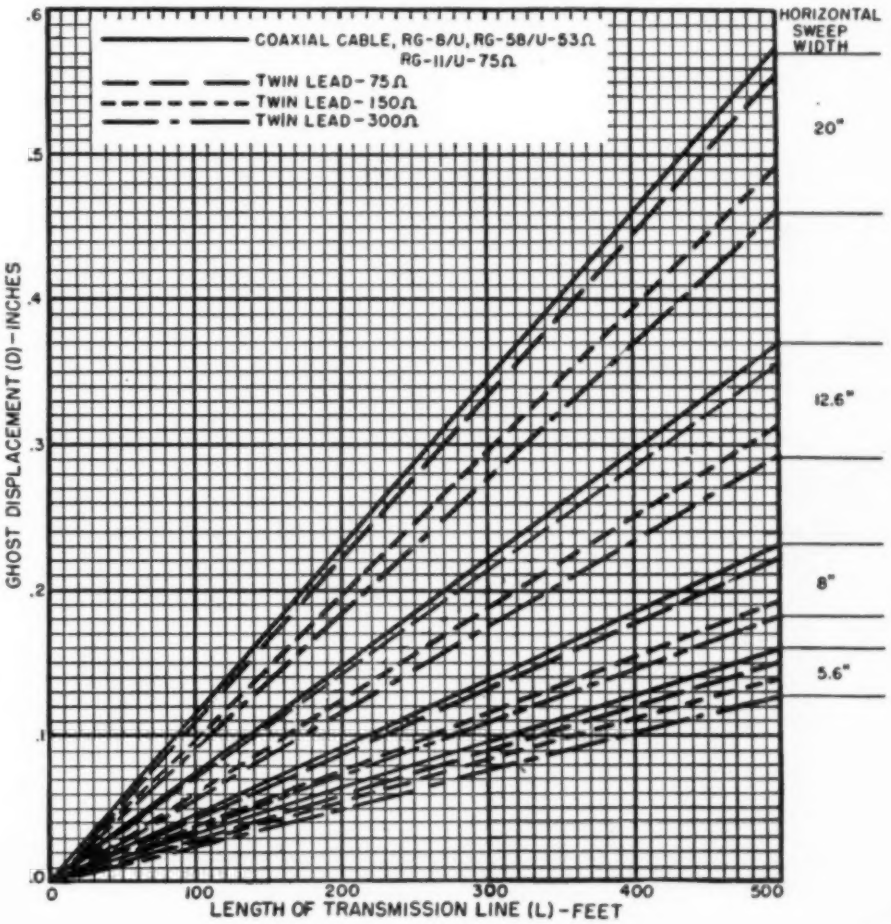
TYPE OF LINE	CHARACTERISTIC IMPEDANCE
Twin Lead	300, 150, 75 ohms
Coaxial RG-8/U, RG-58/U	53 ohms
Coaxial RG-11/U	75 ohms
Twisted Pair	Large Variation

(B)

Receiver	Input Circuit Impedance	Type of Input
Admiral	300 ohms	Balanced
Andrea VJ12	72 ohms	Unbalanced
Belmont	300 ohms	Balanced
Bendix	300 ohms	Balanced
Consolidated	72 ohms	Balanced
Crosley 9-408	300 ohms	Balanced
Crosley 9-407 M	72 ohms	Unbalanced
Du Mont	72 ohms	Unbalanced
Emerson	300 ohms	Balanced
Fada	300 ohms	Balanced
Farnsworth	300 ohms	Balanced
Garod	300 ohms	Balanced
G-E 802	300 ohms	Unbalanced
G-E 810	300 ohms	Balanced
Hallicrafters	300 ohms	Balanced
Industrial TV, Inc.	72 ohms	Unbalanced
Magnavox	300 ohms	Balanced
Motorola	300 ohms	Balanced
National	300 ohms	Balanced
Philco	300 ohms	Balanced
Pilot TV37	300 ohms	Balanced
RCA	300 ohms	Balanced
Scott	72-75 ohms	Unbalanced
Stewart-Warner	300 ohms	Balanced
Stromberg-Carlson	72 ohms	Unbalanced
Tele-Tone	300 ohms	Balanced
U. S. TV Mfg. Co.	100 ohms	Balanced
Westinghouse	300 ohms	Balanced

Table 1. (A) Characteristic impedance of several types of television transmission lines. (B) Characteristics of television receiver input circuits.

Fig. 1. Chart may be used to determine whether ghost images appearing on television screens are caused by multi-path reception or by line mismatch.



RECEIVER IMPEDANCE (OHMS)	LINE IMPEDANCE (OHMS)				
	53	75	106	150	300
72	R_1 = 36 R_2 = 100		R_1 = 62 R_2 = 130	R_1 = 110 R_2 = 100	R_1 = 270 R_2 = 82
100	R_1 = 68 R_2 = 75	R_1 = 47 R_2 = 150		R_1 = 91 R_2 = 180	R_1 = 240 R_2 = 130
150	R_1 = 120 R_2 = 68	R_1 = 100 R_2 = 100	R_1 = 82 R_2 = 200		R_1 = 220 R_2 = 220
300	R_1 = 270 R_2 = 56	R_1 = 270 R_2 = 82	R_1 = 240 R_2 = 130	R_1 = 220 R_2 = 220	

All resistance values are in ohms.
(Pad resistances given in nearest five per-cent RMA preferred values.)
Example: A 300-ohm twin line is to be matched to a 75-ohm balanced receiver.
From table, R_1 = 270 ohms, R_2 = 82 ohms, $\frac{1}{2}R_1$ = 135 ohms.
Pad arrangement is obtained from Fig. 2A.

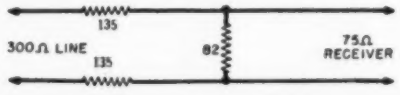


Table 2. Various pad arrangements required when antenna-receiver mismatch occurs.

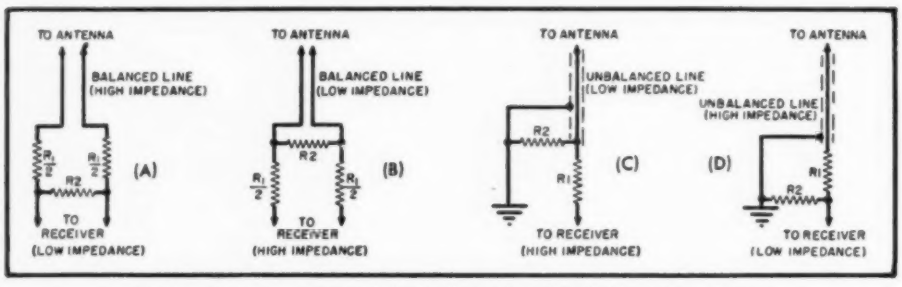


Fig. 2. Pad arrangements for balanced and unbalanced systems.

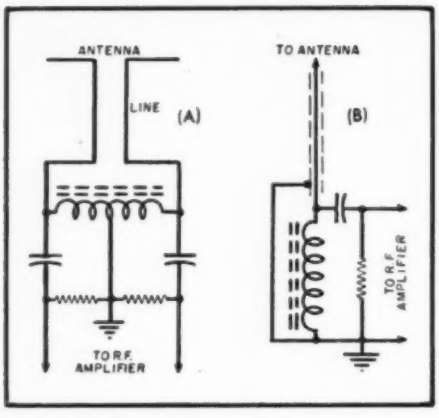


Fig. 3. Conventional balanced input circuit (A) and unbalanced circuit (B).

anced lines; receivers with unbalanced inputs should be operated from unbalanced (single coaxial) lines. If line-balance converters to operate over the TV band are not conveniently available, it will be necessary to make use of expedients when a balanced receiver is operated from an unbalanced line, or an unbalanced receiver is operated from a balanced line. These expedients are discussed in more detail at a later point.

Padding the Line

When a mismatch ghost exists, it can be eliminated by matching the line impedance to the impedance of the receiver input circuit. Matching is accomplished by the insertion of a suitable carbon resistor pad between the line and the receiver input terminals. At television frequencies, both the line impedance and the receiver impedance are resistive for all practical purposes. Accordingly, simple resistive pads serve the purpose and maintain a practical match over all television channels. An unavoidable power loss, however, is the price which must be paid for ghost-free reception, when pads are used. If this insertion loss cannot be tolerated because of low signal level, the only remaining solution is to install a new transmission line which has the same characteristic impedance as the receiver. In many cases, however, the insertion loss of the pad can be tolerated.

To obtain proper impedance relations with minimum insertion loss, L-type pads are recommended. In the case of receivers with balanced input circuits, half the total series resistance (see Fig. 2) is placed in each side of the line. For receivers with unbalanced input circuits the total series resistance is placed in the "hot" side of the line.

The question is sometimes asked why both series and shunt resistors are used to make up a pad. The answer is that two conditions are to be met: the line should "see" its own impedance when looking into the pad-plus-receiver, and the receiver should "see" its own impedance when looking into the pad-plus-line. The reason for the first condition has been explained above. If the receiver does not "see" its own impedance, the input circuit may be disturbed with corresponding impairment of performance.

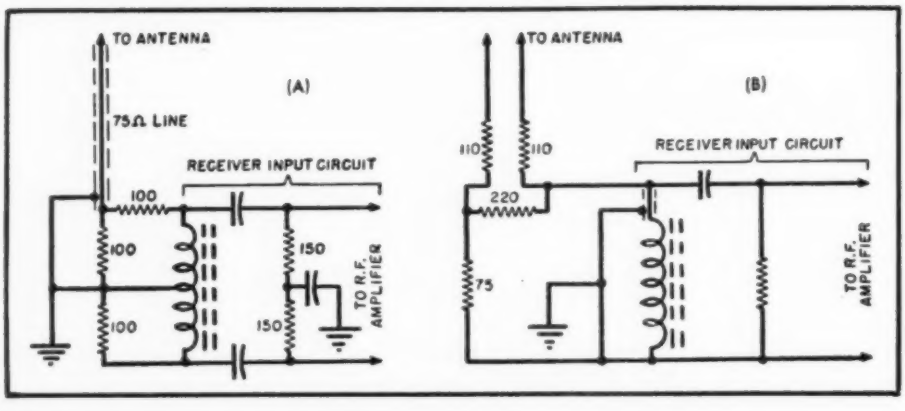
When a pad is designed, reference should be made to Fig. 2 to determine the required circuit. The series resistance is placed in the high-impedance side of the system. In addition, the total series resistance is placed in the "hot" side of an unbalanced line, but in a balanced line, half the total series resistance is placed in each side. The shunt resistance is placed across the low-impedance side of the system.

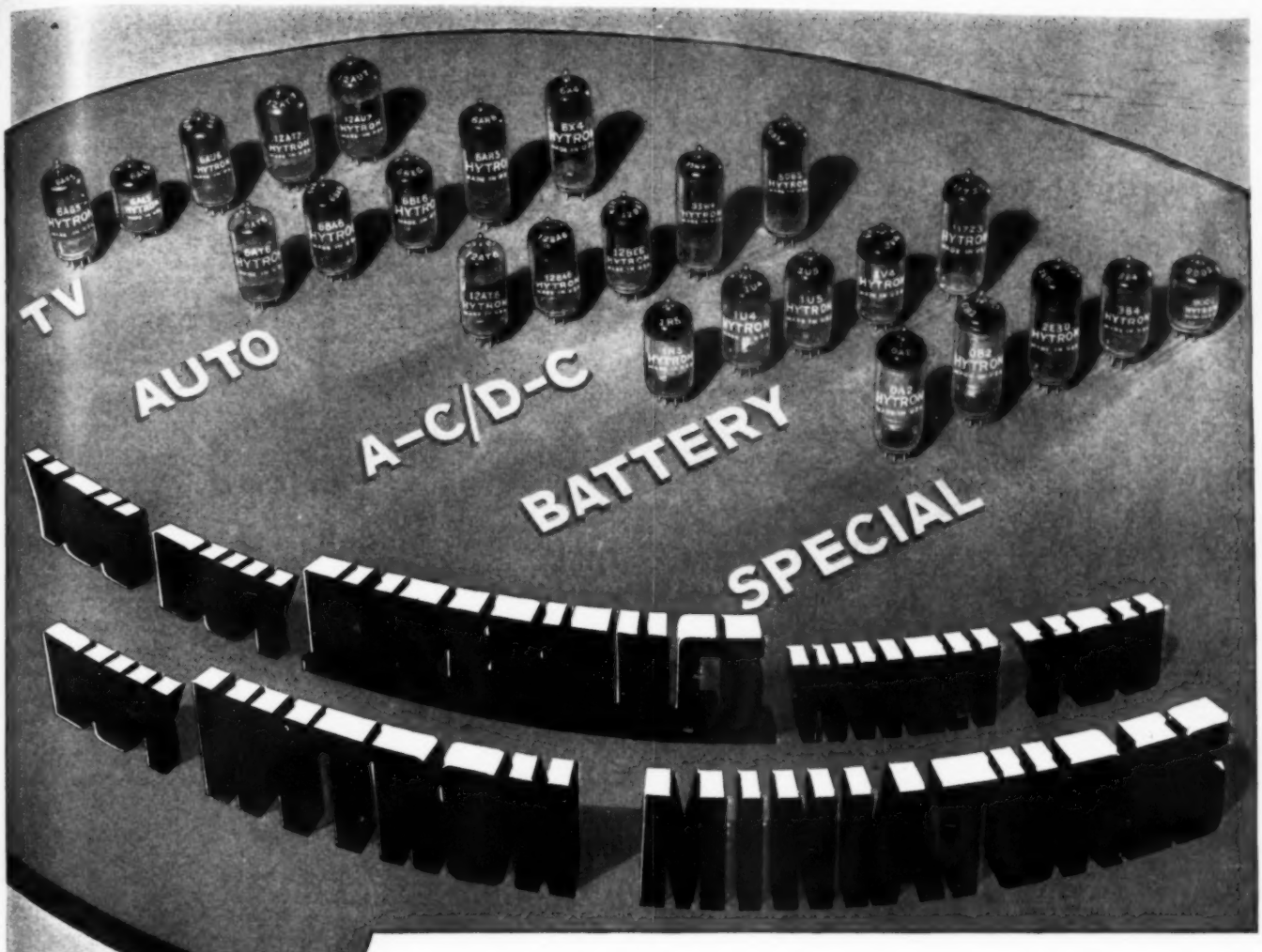
Next, the values of R_1 and R_2 are determined. If the impedances of both the line and receiver are known, the resistance values can be found from Table 2. If the impedances are unknown, the values may be found by experiment. To determine the values of R_1 and R_2 experimentally, two (or three) potentiometers having at least 300 ohms of resistance are hooked up into the required pad circuit. Only carbon-type potentiometers should be used because wirewound elements have excessive inductance. The settings of the potentiometers are varied until the ghost disappears. Adjustment of the contrast control may be required to maintain satisfactory picture brightness. The values of potentiometer resistance are then measured with an ohmmeter, and the nearest values of small fixed carbon resistors are made up into a pad and permanently installed.

Inspection of Table 2 shows that

(*Continued on page* 98)

Fig. 4. (A) An unbalanced line matched to a balanced receiver input circuit. (B) A balanced line matched to an unbalanced receiver input circuit.





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The efficiency of class B linear amplifiers and of class C grid-modulated stages is about 30%; that of cathode-modulated amplifiers about 55%. This means that the class B linear and the class C grid-modulated finals will give about 300 watts output with the legal input of 1 kw., while the cathode-modulated final will give about 550 watts output for 1 kw. input. So far, so good. That's all right, we say, because surplus tubes and equipment are cheap and we make a big saving on modulation equipment. Furthermore, the decibels difference between a 550 watt cathode-modulated carrier and a 750 watt plate-modulated carrier hardly is worth the higher cost of plate modulation. But the picture is not as rosy as it appears at first glance—and plate dissipation of the tube is the fly in the ointment.

Plate dissipation puts a limit on the maximum amount of power we can put into the EM final. We cannot just dump 1000 watts into a tube rated to take that much input, and then take out 300 watts of r.f. unless the plate dissipation rating is high enough to "take" the remaining 700 watts difference. In the case of a cathode-modulated final running at 1 kw. input, the plate must dissipate the 445 watts difference!

There is a certain maximum amount of power which any tube will handle safely in an efficiency-modulated amplifier without exceeding the plate dissipation. And we should not exceed that input value. What we can do with a surplus tube in an EM final depends, therefore, upon the plate dissipation of the tube.

For the convenience of the reader, the accompanying table has been prepared to show the highest EM input power and corresponding output power for 20 of the most suitable surplus tubes. No tube has been included in this list if its dissipation figure is lower than 100 watts. The wattages in the table are for single tubes. Twice as much input and output can be expected with two tubes in push-pull or parallel. —30—

Highest EM input power and corresponding output power for twenty popular tubes.

TUBE TYPE	CLASS C GRID MOD. or CLASS B LINEAR		CATHODE MOD.	
	Input	Output	Input	Output
100TH	150	50	333	183
VT127A	150	50	333	183
204A	375	125	555	305
211	150	50	333	183
250TH, 250TL, 304TH	375	125	555	305
304TL	450	150	666	366
450TH	675	225	1000	555
527	450	150	666	366
805	187	62.2	278	154
806	337	112	500	275
810	225	75	334	184
813	150	50	333	183
822	300	100	445	245
833A	675	225	1000	555
838	150	50	333	183
845	150	50	333	183
852	150	50	333	183
860	150	50	333	183

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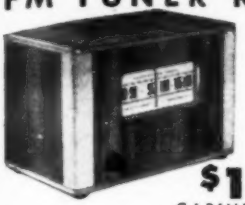

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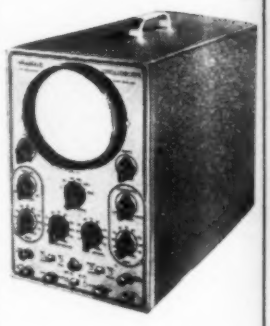

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$39.50

Nothing ELSE TO BUY

1949 MODEL Heathkit VACUUM TUBE VOLTMETER KIT

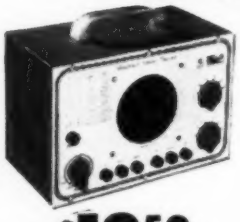
Features

New 200 ua Meter.
24 Ranges.
New Accessory H.V. Probe makes Heathkit a kilovoltmeter. (Extra)
New Accessory RF Probe extends range to 100 megacycles. (Extra)

A new Model V-2 Heathkit VTVM with new 200 microampere meter, four additional ranges — full scale linear ranges on both AC and DC of 0-3 V., 10 V., 30 V., 100 V., 300 V. and 1,000 V. Accessory probe listed elsewhere in ad extends voltage range to 3,000 and 10,000 volts D.C. New model has greater sensitivity, stability and accuracy — still the highest quality features — shatterproof plastic full view meter face — automatic meter protection, push pull electronic voltmeter circuit, linear scales — db. scale — ohmmeter measures 1/10 ohm to 1 billion ohms with internal battery — isolated DC test prod for dynamic measurements — 11 megohm input resistance on DC — AC uses electronic rectification with 6H6 tube. All these features and still the amazing price of only $24.50. Comes complete with cabinet — panel — three tubes — new Mallory switches — test prods and leads, 1% ceramic divider resistors and all other parts. Complete instruction manual for assembly and use. Better start your laboratory with this precision instrument. Ship. Wt., 8 lbs.

$24.50

New Heathkit SIGNAL TRACER AND UNIVERSAL TEST SPEAKER KIT



$19.50

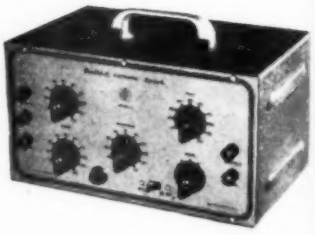
Nothing ELSE TO BUY

The popular Heathkit signal tracer has now been combined with a universal test speaker at no increase in price. The same high quality tracer follows signal from antenna to speaker — locates intermittents — defective parts quicker — saves valuable service time — gives greater income per service hour. Works equally well on broadcast — FM or TV receivers. The test speaker has assortment of switching ranges to match push pull or single output impedance. Also tests microphones, pickups — PA systems — comes complete — cabinet — 110 V. 60 cycle power transformer — tubes, test probe, all parts and detailed instructions for assembly and use. Shipping Wt., 8 lbs.

Heathkit ELECTRONIC SWITCH KIT

DOUBLES THE UTILITY OF ANY SCOPE

An electronic switch used with any oscilloscope provides two separately controllable traces on the screen. Each trace is controlled independently and the position of the traces may be varied. The input and output traces of an amplifier may be observed one beside the other or one directly over the other illustrating perfectly any change occurring in the amplifier. Distortion — phase shift and other defects show up instantly, 110 Volt 60 cycle transformer operated. Uses 5 tubes (1 6X5, 2 6SN7's, 2 6SJ7's). Has individual gain controls, positioning control, and coarse and fine sweeping rate controls. The cabinet and panel match all other Heathkits. Every part supplied including detailed instructions for assembly and use. Shipping Wt., 11 lbs.

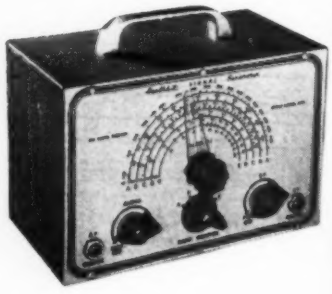


$34.50

Heathkit RF SIGNAL GENERATOR KIT

$19.50

Nothing ELSE TO BUY



Every shop needs a good signal generator. The Heathkit fulfills every servicing need, fundamentals from 150 Kc. to 30 megacycles with strong harmonics over 100 megacycles covering the new television and FM bands. 110 V. 60 cycle transformer operated power supply.

400 cycle audio available for modulation or audio testing. Uses 6SN7 as RF oscillator and audio amplifier. Complete kit has every part necessary and detailed blueprints and instructions enable the builder to assemble it in a few hours. Large easy to read calibration. Convenient size 9" x 6" x 4¾". Shipping Wt., 4½ lbs.

Heathkit 3-TUBE ALL WAVE RADIO KIT

$8.75

An ideal way to learn radio. This kit is complete ready to assemble, with tubes and all other parts. Operates from 110 V. AC. Simple, clear detailed instructions make this a good radio training course. Covers regular broadcasts and short wave bands. Plug-in coils. Regenerative circuit. Operates loud speaker. Shipping Wt., 3 lbs.

HS30 Headphones per set	$1.00
2½" Permanent Magnet Loudspeaker	1.95
Mahogany Cabinet	2.95

The HEATH COMPANY

★ ★ ★ . . . BENTON HARBOR 15, · MICHIGAN

EQUIPMENT must be good!

Heathkit engineer calibrating Heathkit VTVM using Weston and General Electric laboratory standards.

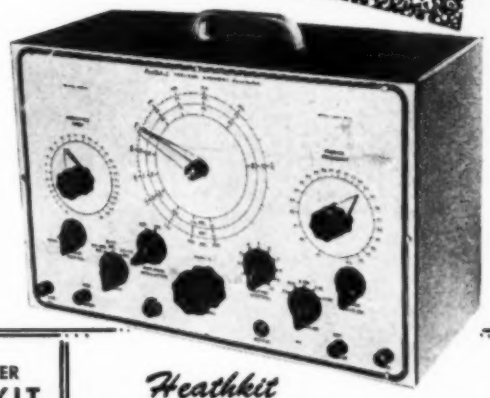
MATCHED TO THE HIGHEST PRECISION STANDARDS . . .

Heathkit technician calibrating condensers for Heathkit Condenser Checker using General Radio capacity bridge of 1% accuracy.

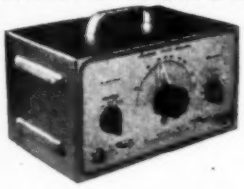
New Heathkit
TELEVISION ALIGNMENT GENERATOR KIT

Everything you want in a television alignment generator. A wide band sweep generator covering all FM and TV frequencies — a marker indicator — AM modulation for RF alignment — variable calibrated sweep width 0-30 Mc. — mechanical driven inductive sweep. Husky 110 V. 60 cycle power transformer operated — step type output attenuator with 10,000 to 1 range — high output on all ranges — band switching for each range — vernier driven main calibrated dial with over 45 inches of calibrations — vernier driven calibrated indicator marker tuning. Large grey crackle cabinet 16-1/8" x 10-5/8" x 7-3/16". Phase control for single trace adjustment. Uses four high frequency triodes plus 5Y3 rectifier — split stator tuning condensers for greater efficiency and accuracy at high frequencies — this Heathkit is complete and adequate for every alignment need and is supplied with every part — cabinet — calibrated panel — all coils and condensers wound, calibrated and adjusted. Tubes, transformer, test leads — every part with instruction manual for assembly and use. Actually three instruments in one — TV sweep generator — TV AM generator and TV marker indicator. Also covers FM band. Deliveries start early in March. Order early.

$39.50



Heathkit
SINE AND SQUARE WAVE AUDIO GENERATOR KIT



$34.50
Nothing
ELSE TO BUY

Experimenters and servicemen working with a square wave for the first time invariably wonder why it was not introduced before. The characteristics of an amplifier can be determined in seconds compared to several hours of tedious plotting using older methods. Stage by stage, amplifier testing is as easy as signal tracing. The low distortion (less than 1%) and linear output (± one db.) make this Heathkit equal or superior to factory built equipment selling for three or four times its price. The circuit is the popular RC tuning circuit using a four gang variable condenser. Three ranges 20-200, 200-2,000, 2,000-20,000 cycles are provided by selector switch. Either sine or square waves instantly available at slide switch. All components are of highest quality, cased 110 V. 60 cycle power transformer, Mallory F.P. filter condensers, 5 tubes, calibrated 2 color panel, grey crackle aluminum cabinet. The detailed instructions make assembly an interesting and instructive few hours. Shipping Wt., 13 lbs.

110 V. A.C. MILITARY RECEIVER POWER SUPPLY KIT

$5.95

Ideal way to convert military sets. 110 V. 60 cy. transformer operated. Supplies 24 volts for filament — no wiring changes inside radio. Also supplies 250 V. D.C. plate voltage at 50-60 MA. Connections direct to dynamotor input. Complete with all parts and detailed instructions. Ship. Wt., 6 pounds.

110 V. A.C. TRANSMITTER POWER SUPPLY KIT

$14.50

For BC-645, 223, 522, 274N's, etc. Ideal for powering military transmitters. Supplies 500 to 600 volts at 150 to 200 MA plate, 6.3 C.T. at 4 Amps., 6.3 at 4 Amps., and 12 V. at 4 Amps. Can be combined to supply 3-6-9-12 or 24 volts at 4 amperes. Kit supplied complete with husky 110 V. 60 cycle power transformer, 5U4 rectifier, oil filled condensers, cased choke, punched chassis, and all other parts, including detailed instructions. Complete — nothing else to buy. Shipping Wt., 22 lbs.

Heathkit
CONDENSER CHECKER KIT

$19.50
Nothing
ELSE TO BUY

Features

- Bridge type circuit
- Magic eye indicator
- 110 V transformer operated
- All scales on panel
- Power factor scale
- Measures resistance
- Measures leakage
- Checks paper-mica-electrolytics

Checks all types of condensers, paper-mica-electrolytic-ceramic over a range of .00001 MFD to 1000 MFD. All on readable scales that are read direct from the panel. NO CHARTS OR MULTIPLIERS NECESSARY. A condenser checker anyone can read without a college education. A leakage test and polarizing voltage for 20 to 500 volts provided. Measures power factor of electrolytics between 0% and 50%. 110 V. 60 cycle transformer operated complete with rectifier and magic eye tubes, cabinet, calibrated panel, test leads and all other parts. Clear detailed instructions for assembly and use. Why guess at the quality and capacity of a condenser when you can know for less than a twenty dollar bill. Shipping Wt., 7 lbs.

The HEATH COMPANY
. . . BENTON HARBOR 15, MICHIGAN

ELECTRONIC BARGAINS *for* EXPERIMENTERS *and* HOBBYISTS

ORDER NOW . . ALL QUANTITIES LIMITED

PE101C BC645 POWER SUPPLY
NO. 273. Complete power supply for BC 645. Operates from 12 or 24 Volts. Supplies both AC and DC required. Shipping Wgt. 13 lbs. Each **$3.95**

DM 35 12 VOLT DYNAMOTOR
NO. 274. New input 12 Volt at 18.7 Amperes. Supplies 675V at 275 MA or ½ above voltage from 6 volts. Excellent for auto use. Shipping Wgt. 11 lbs. Each **$7.50**

HOME WORKSHOP GRINDER KIT
NO. 230. Easily assembled 110V AC or DC ball bearing fully enclosed motor from Army surplus dynamotor. Purchaser to make simple changes and shaft extensions, detailed instructions and all parts supplied. Motor approximately 5,000 R.P.M. Ideal for tool-post grinder, flexible shaft tool, model drill press, saw. Shipping Weight 6 lbs. **$3.95**

COLLINS AUTOTUNE CONTROL HEAD
NO. 278. Brand new controls used on the ART/13, 100 Watt, Transmitter. Types 7, 8, 10, and 11 available. Get a spare while available as new cost is over $22.00 each. Shipping Wgt. 3 lbs. Price any type (mention when ordering). Each **$4.50**

300 MA SELENIUM RECTIFIERS
NO. 209. Rated 300 MA at 36 Volts, complete with mounting brackets. Shipping Wgt. 1 lb. 3 FOR $1.00

1N90 FEED THROUGH INSULATOR
NO. 276. Heavy duty feed through, 2" diameter 4" long, complete with brass hardware and gasket. Shipping Wgt. 2 lbs. 2 FOR **$1.00**

1N86 STRAIN INSULATOR
NO. 277. Husky army type 1¼" diameter, 5¼" long. Brown porcelain. Shipping Wgt. 4 lbs. 4 FOR **$1.00**

G.E. BC 306 ANTENNA TUNING UNIT
NO. 231. Matches any aerial to 150 Watt transmitter, used on BC 375. Brand new. Add postage for 20 lbs. **$2.95**

G. E. 1,000 VOLT 350 MA DYNAMOTOR
NO. 213. An ideal dynamotor for mobile operation in taxicabs, police cars, sound systems and amateur stations. Supplies above voltage from 12 Volts or 500V. at 350 MA from 6 Volts. Complete with starting relay, and fuses. New. Our Dynamotor A. Shipping Weight 72 lbs. **$5.95**

POWER TRANSFORMER *Specials*
NO. 226. Primary 117V. 60 cycle. Secondaries supply 746 V.CT at 220 MA, 6.3V. at 4.5 A., and 5V. at 4A. Will handle 13 tube radio receivers. Supply is limited, order early. Shipping Weight 11 lbs. each.
$3.95 . . 3 for $9.95

T32 TABLE MICROPHONE
NO. 210. One of the Army's best. Built by Kellogg, ideal for factory call system, public address, amateur use. Brand new in original cartons. Add postage for 5 lbs. **$2.95**

MINIATURE ELECTRIC MOTOR
NO. 211. Tiny Delco motor only 1" x 1¼"x2" 10,000 RPM. Operates from 6 to 24 V. Excellent for models. Add postage for 1 lb. **$2.95**

OUTPUT TRANSFORMER
NO. 227. Push pull 6V6's to 6 - 8 ohm voice coil excellent characteristics, 3 for $1.95

RCA SATURABLE REACTOR TRANSFORMER
NO. 246. New RCA No. CKV30531 AC current 750 MA DC current 2 Amperes. Rated 1.75 henries. Shipping wgt. 4 lbs. Each **$1.00**

12.6V POWER TRANSFORMER
NO. 247. New cased 110 V 60 cy. Power Transformer. Supplies 440V Ct. at 60 MA, 6.3V at 2A. and 12.6V at 1 Amp. Excellent for military sets. Shipping Wght. 6 lbs. Each. **$1.95**

RCA INPUT TRANSFORMER
NO. 248. Heavy duty RCA No CKV-30529. Input has primaries 600 to 200 and 25 ohms secondary 250,000 ohms C.T. Shipping Wgt. 2 lbs. Each **$1.00**

FEDERAL POWER TRANSFORMER
NO. 252. New cased 110V 60 cy. Power Transformer. Supplies 480V CT at 50 MA and 6.3 V at 2.1 Amps. A beautiful transformer. Shipping Wgt. 4 lbs. Each **$1.50**

MILITARY POWER TRANSFORMERS
NO. 229. Convert your military receivers without rewiring the filament. "A" type supplies 500 VCT at 50 MA, 5V. at 2A. and 24V. at ½ A. "B" type supplies 500 VCT at 50 MA, 5V. at 2A. and 12V. at 1 Amp. State whether A or B type desired. Shipping Weight 4 lbs. **$2.95**

WALKIE TALKIE TRANSFORMER
No. 744. Carbon microphone input transformer and output to headphone transformer, all in one case, excellent for building your own. Shipping Wt. 1 lb. 4 for $1.00

LOW PASS FILTER UNIT
No. 637. 3000 cycle cutoff consists of 3 inductances and 4 capacitors in network, 500 ohms in and out. Excellent for clipping all frequencies above 3000 cycles. Drawn steel case, shipping Wt. 5 lbs. $2.50

FM PUSH BUTTON TUNER
NO. 224. Brand new ten push button tuning assembly from Army FM receiver. Contains 4 gang 100 MMF silver plated tuning condenser. Add postage for 10 lbs. **$2.50** EACH

BC 746 TUNING UNIT
NO. 257. Plug in transmitter tuning unit from army Walkie Talkie. Contains antenna and tank coils, tuning condenser, transmitting and receiving crystals. Ideal transmitter foundation. Shipping Wgt. 1 lb. Each **$1.00**
(Same as above except transmitter crystal in 80 meter amateur band $2.50 each)

T30 THROAT MICROPHONE
NO. 258. Makes excellent contact microphone for musical instrument or vibration pick-up. Shipping Wgt. 1 lb. $1.00 each
Extension cord with switch for above $ .50 each

BC731 CONTROL BOX
with Weston Model 476 AC Voltmeter
NO. 208. Excellent buy in motor control box. Size 8"x10"x5½". Contains Weston 0-150V. AC 3½" voltmeter, motor starting switch, 28 fuses all 30 Amp 110V. and 8 fuse holders. Fuses and holders alone worth the price. Shipping Weight 18 lbs. **$7.95**

METER SPECIAL
NO. 237. Brand new DeJur Model 312 0-800 M.A. D.C. Square 3" 0-10 M.A. basic meter with built in shunt. Probably the best buy ever offered in a surplus meter. Shipping Weight 1 lb. **$2.95**

HEARING AID HEADPHONES
NO. 216. The Army's best — eliminate flat ears and outside noise. Complete with transformer for conversion from low to high impedance. With cord and plug complete.
Add postage for 1 lb. **$1.00**

BC 451 CONTROL BOX
NO. 236. Control box for 274N transmitters. Contains proper cw-voice switch, 4 channel switch, power switch, mike jack and telegraph key.
Add postage for 2 lbs. $1.95

100 MA FILTER CHOKE
No. 641. Heavy 1.5 henry choke in drawn steel case, 50 ohm resistance, conservatively rated at 100 MA. Shipping Wt. 1 lb. 50c

FILAMENT TRANSFORMER
No. 922. 220V. 60 cy. primary supplies 12.6V. at 3.5 Amps, 15.6V at 1 Amp. Supplies 6.3 at 3.5 Amps and 7.8V. at 1. Amp from 110V. Shipping Wt. 8 lbs. $1.50

PANEL METER
Burlington O-300 VAC Meter
No. 290. Model 32XA 3½" round AC Voltmeter 0-300 VAC full scale. Scale also calibrated 0-600V. Bakelite case. A beautiful meter in original carton. Shipping Wt. $3.95

DRIVER TRANSFORMER
No. 651. Couples 3000 ohm plate to push pull parallel grids hermetically sealed. Ship. Wt. 1 lb. $1.00

OUTPUT and MODULATION TRANSFORMER
No. 745. Companion transformer to above driver. A push pull output, 3000 ohms to 3.2 ohm voice coil, or to 1250 ohms at 80 MA. A high quality cased unit. Shipping Wt. 2 pounds. $1.00

HOW TO ORDER • • • GIVE PART NUMBER AND DESCRIPTION . . . ADD POSTAGE FOR WEIGHT SHOWN. NO ORDERS UNDER $2.00 . . . WE WILL SHIP C.O.D.

The HEATH COMPANY
. . . BENTON HARBOR 15, MICHIGAN

TENTATIVE PROGRAM OF EVENTS

1949 RADIO PARTS AND ELECTRONIC EQUIPMENT SHOWS, INC.

SUNDAY, MAY 15th

9:00 a.m. Exhibition Hall open for erection of displays
Sales meetings should be held on this day and prior days

MONDAY, MAY 16th—"ASSOCIATIONS' MEETING DAY"

9:00 a.m. Exhibition Hall open for erection of displays
10:00 a.m. National Electronic Distributors Association—General Meeting
10:30 a.m. "The Representatives" of Radio Parts Mfrs., Inc.—General Meeting
12:00 Noon "Canadian Luncheon"—Radio Parts Sales Managers Ass'n. of Canada
12:30 p.m. "The Representatives" of Radio Parts Mfrs., Inc.—Luncheon
2:00 p.m. Sales Managers Club, Eastern Division, Ass'n. of Electronic Parts & Equipment Mfrs., and West Coast Electronic Mfrs. Ass'n.—Joint Meeting
2:30 p.m. "The Representatives" of Radio Parts Mfrs., Inc.—Delegates Meeting
3:30 p.m. Radio Parts & Electronic Equipment Shows, Inc.—Annual Meeting of Member-Exhibitors and General Members
6:30 p.m. "Old Timers" Cocktail Party

TUESDAY, MAY 17th—"NEDA DAY" (Exclusive)

10:00 a.m. Exhibition Hall opens for exhibiting manufacturers, booth attendants sales representatives and members of Nat'l. Electronic Distributors Ass'n.
10:00 a.m. Display rooms on fifth and sixth floors open to all distributors, manufacturers and sales representatives
6:00 p.m. Exhibition Hall and Display rooms close

WEDNESDAY, MAY 18th

10:00 a.m. Display rooms on fifth and sixth floors open to all distributors, manufacturers and sales representatives
10:00 a.m. Exhibition Hall opens
10:00 a.m. to 1:00 p.m. Attendance confined to exhibiting manufacturers, their booth attendants, sales representatives and members of NEDA
1:00 p.m. to 3:00 p.m. Attendance confined to exhibiting manufacturers, their booth attendants, sales representatives and all distributors
3:00 p.m. to 6:00 p.m. Attendance confined to exhibiting manufacturers, their booth attendants, sales representatives, all distributors, industrial manufacturers, government agencies, their purchasing agents and engineers
6:00 p.m. Exhibition Hall and Display rooms close

THURSDAY, MAY 19th

10:00 a.m. Display rooms on fifth and sixth floors open to all distributors, manufacturers and sales representatives
10:00 a.m. Exhibition Hall opens
10:00 a.m. to 1:00 p.m. Attendance confined to exhibiting manufacturers, their booth attendants, sales representatives and members of NEDA
1:00 p.m. to 3:00 p.m. Attendance confined to exhibiting manufacturers, their booth attendants, sales representatives and all distributors
3:00 p.m. to 6:00 p.m. Attendance confined to exhibiting manufacturers, their booth attendants, sales representatives, all distributors, industrial manufacturers, government agencies, their purchasing agents and engineers
6:00 p.m. Exhibition Hall and Display rooms close
7:00 p.m. Dinner—RMA's "Silver Anniversary" Banquet, Grand Ballroom, Stevens

FRIDAY, MAY 20th

10:00 a.m. Display rooms on fifth and sixth floors open to all distributors, manufacturers and sales representatives
10:00 a.m. Exhibition Hall opens
10:00 a.m. to 1:00 p.m. Attendance confined to exhibiting manufacturers, their booth attendants, sales representatives and members of NEDA
1:00 p.m. to 3:00 p.m. Attendance confined to exhibiting manufacturers, their booth attendants, sales representatives and all distributors
3:00 p.m. to 6:00 p.m. Attendance confined to exhibiting manufacturers, their booth attendants, sales representatives, all distributors, industrial manufacturers, government agencies, their purchasing agents and engineers
6:00 p.m. Exhibition Hall and Display rooms close
1949 Radio Parts & Electronic Equipment Conference & Show ends

DO YOU KNOW?

By DAVID SCOTT

54. What may be the result of variations in the velocity of the electron stream?

A. *Variations in the velocity of the electron stream will cause defocusing. Since electrostatic deflection depends on the square of the electron velocity, whereas magnetic deflection depends only on the first power, this source of defocusing is more serious when electrostatic deflection is used.*

55. What may be the result of the ion spot?

A. *The result is a dark spot in the center of the reproduced picture.*

56. In what type of deflection is the ion spot most troublesome?

A. *In magnetic deflection the ion spot is quite apparent and eventually this continual bombardment of heavy ions on one spot will burn that portion of the screen. This is due to the fact that in magnetic deflection the deflection is inversely proportional to the square root of the mass of the particles. Since the ions have a mass of 1800 to 500,000 times that of the electron mass there is a correspondingly smaller deflection and they cluster in the center.*

57. Define a saw-tooth waveform.

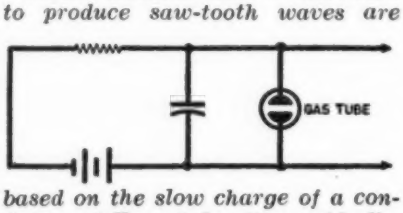
A. *A saw-tooth waveform is one in which the deflection voltage or current increases linearly with time and decreases rapidly to its initial value.*

58. What is the keystone effect?

A. *In the iconoscope there is a 30 degree angle of the beam to the plate. Due to the difference in distance resulting from this angle from the top to the bottom of the plate by the scanning beam, an unequal amplitude of scanning results giving rise to a pattern keystone in shape.*

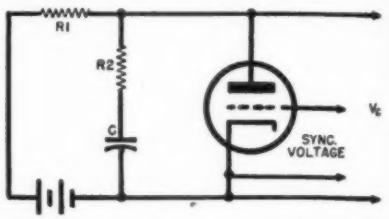
59. Draw a simple schematic diagram illustrating and explaining methods of producing saw-tooth waves of voltage.

A. *All methods used in television to produce saw-tooth waves are based on the slow charge of a condenser followed by its rapid discharge. A simple circuit for achieving this, though not used practically, is as follows: A tube with two electrodes immersed in gas at low pressure is connected across the terminals of a condenser. As the voltage across the condenser increases, the gas tube remains nonconducting until a critical voltage is reached. Then the gas tube suddenly becomes conductive and discharges the condenser resulting in a saw-tooth wave. In order to exercise some control over the tube action a three element tube, gassy or hard, is used. The control grid is used to carry a synchronizing impulse which discharges the tube at a fixed rate.*



60. Draw a simple schematic diagram illustrating and explaining methods of producing saw-tooth waves of current.

A. *Saw-tooth waves from a condenser alone cannot be used to provide saw-tooth waves of current necessary in magnetic deflection. This is because the deflecting coils possess inductance and resistance. Hence, a current passing through them becomes distorted. Therefore a pre-distorted voltage must be applied to the coils to produce a saw-tooth wave of current. This "predistortion" is accomplished by placing a resistor in series with the condenser as shown in the diagram.*



61. What are some of the necessary design qualities of voltage waveform amplifiers?

A. *Voltage waveform amplifiers must be flat up to ten times the scanning frequency, i.e., 60x10=600 c.p.s in the vertical amplifier and 15,750x10=157,500 c.p.s. in the horizontal amplifier. The angular phase displacement of the sine wave components must be proportional to the frequency, and both deflecting plates must be symmetrically disposed with respect to the second anode to keep the field between the plates as uniform as possible.*

62. What are the three important types of impulse generators?

A. Three important types of impulse generators are:

1. *Dynatron*
2. *Multivibrator*
3. *Blocking oscillator.*

(To be continued)

YOUR DOLLAR BUYS MORE AT McGEE RADIO COMPANY

"COMPLETE AUDIO AMPLIFIER KIT AS LOW AS $6.95"

12-WATT AMP. KIT, $10.95

Gain for V.R. Pick-Up

KIT MODEL TM-12. 12 watt amplifier kit. Ideal for high quality record player as well as public address or recording amplifier. Matched components, ready punched chassis pan, one control fades from phono to microphone. Gain enough for crystal or dynamic microphone. 100 mill power transformer, for 110 volt AC 60 cycle operation, priced complete with tubes: 2—6V6, 6SN7, 6H7 and rectifier. Diagrams and photos furnished. Weight 8 lbs. Kit TM-12. Net **$10.95.**

8-Watt AC Amplifier Kit $8.95 WITH PUSH PULL 6AQ5

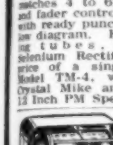
A complete Kit of parts to build a 8 Watt Power transformer type Audio Amplifier for 110 Volt AC operation. Inputs for mike and phono pickup either crystal or variable reluctance type. Variable tone and fader control. Output transformer matches 6 to 8 Ohm speaker. Ready punched chassis similar in appearance to Model TM-12 shown above. Price includes easy to follow diagram and tubes, 2—6AQ5, 2—12AX7, and 5Y3. This amplifier will make a fine radio system. Remember this is not any ordinary AC-DC Amp, but an AC job with 8 Mill Power Transformer. Kit Model TM-8, weight 10 lbs. Net **$8.95.** Crystal Mike & Desk Stand **$4.95** extra. 12 Inch Alnico V PM Speaker **$4.95** extra.

5-WATT AMP. KIT $6.95 PUSH PULL 50B5

A complete Kit of parts to build a 5 Watt Audio Amplifier, for 110 Volt AC-DC operation. Inputs for mike and any phono pickup crystal or variable reluctance. Output transformer matches 4 to 6 Ohm voice coil. Has tone and fader controls. This is a complete Kit with ready punched chassis and easy to follow diagram. Everything furnished including tubes, 2—12AV7, 2—50B5, plus selenium Rectifier. Offered at the usual price of a single output type Amp. Kit Model TM-4, weight 6 lbs. Net **$6.95.** Crystal Mike and desk stand **$4.95** extra. 12 Inch PM Speaker **$4.95** extra.

GAROD DELUXE 5-Tube Kit $12.95

This is our latest and finest AC-DC radio kit. Receives Broadcast, 540 to 1650 KC. Has full length illuminated slide rule dial. Choice of Ivory or Walnut plastic cabinet. Full high efficiency 2 gang superhet circuit, with loop antenna. Ready punched chassis, full 5" PM speaker. Every part fits. Everything furnished, including tubes. 12SA7, 14A7, 12SQ7, 35Z3 and 50L6. Diagram photos and instructions are furnished. Shipping weight 9 lbs. Kit model XA-49. Net **$12.95.**



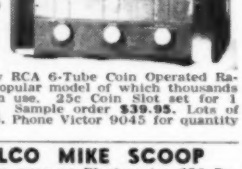
WALNUT ARM CHAIR CABINET $29.95

WILL HOUSE CRP-15 KIT. Beautifully made walnut armchair cabinet. Outside dimensions 24" high, 16½" deep and 27" wide. Ample room for radio receiver 14" long, 9" high, and 10" deep. Will hold a changer up to 14" square. Will accommodate speaker up to 12". Has record album storage compartment. Hinged lid covers changer compartment. Cabinet AR-15. Net price **$29.95.** Crescent Deluxe changer **$14.95** extra. Armchair cabinet in blonde finish. Net price **$34.95.**

A few items of war surplus are still available.

Brand new 458 5.3 to 7.1 MC trns. with tubes..... **$5.95**
Used BC 458 transmitter with tubes **2.95**
Used 456 modulators with tubes..... **2.95**
New BC 733D localizer rec. with tubes **6.95**
ARC-4 trand. rec. 144MC used with tubes and dynamotor..... **12.95**
200 KC crystal calibrator for Collins autotune less tubes and crystal.. **1.00**
BC 1033A Marker Beacon Rec. tubes.. **2.95**

R.C.A. COIN RADIOS $34.95



Brand New RCA 6-Tube Coin Operated Radio. The popular model of which thousands are now in use. 25c Coin Slot set for 1 hour play. Sample order **$39.95.** Lots of 10 **$33.95.** Phone Victor 9045 for quantity prices.

PHILCO MIKE SCOOP

Philco Mike same as Electrovoice 630 Dynamic High Z, 20 Ft. of Cable. Regular, $36.50. Scoop price, **$14.95.** 3 for **$41.95.**

Philco Mike same as Electrovoice VI Velocity, High Z, 20 Ft. of Cable, $40.00 list. Price, **$14.95.** 3 for **$41.95.**

Philco Mike same as Electrovoice 726 Cardyne Dynamic High Z, 20 Ft. Cable. $50.50 list. Scoop price, **$24.95.**

RADIO TUBE SCOOP!

Service men attention. Here is a chance to buy the best tubes money can buy. 6 GT types. Designed to replace either metals or gt. New internal construction makes metal tubes obsolete. All 1949 dated by a maker whose name you will know.

12SA7	69c	100 for	**$59.00**
12SK7	69c	100 for	**59.00**
12SQ7	69c	100 for	**59.00**
35L6	69c	100 for	**59.00**
5016	69c	100 for	**59.00**
35Z5	49c	100 for	**42.50**

All are MFGR8 type bulk packed 100 to a carton.

20-WATT AMP. KIT $15.95 HAS-P.P.6L6

A complete Kit of parts to build a high quality 20 Watt Audio Amplifier with full 135 Mill Power Transformer for 110 Volt AC operation. Inputs for mike and either crystal or variable reluctance pick ups. Tone and fader controls. Has heavy duty Universal Output Transformer to match any speaker. 4—8—16—250 and 500 ohms. Ready punched chassis. Easy to follow diagram. Furnished with Tubes, 2—6L6, 2—7N7, 5V4 or 7Z4. Kit Model TM-20, weight 20 lbs. Net **$15.95.** Crystal Mike & Desk Stand **$4.95** extra. Speaker recommended Model CR-13X **$12.95** extra.

SUPER DELUXE 30-WATT AMP. KIT $19.95

A complete Kit of parts to build a full 30 Watt Public Address Amplifier. Ready punched chassis with cover. 160 Mill Power Transformer, for 110 Volt AC operation. Inputs for two mikes and Crystal or Variable Reluctance Phono Pick up. Tone Control. Has heavy duty output transformer to match any speaker. 4—8—16—250 and 500 Ohms. Inverse Feed Back. Everything furnished including easy to follow diagram and tubes 2—6SJ7, 2—7N7, 2—6L6, 5V4. This makes a ready saleable amplifier of commercial quality. Kit Model TM-30, weight 25 lbs. Net **$19.95.** With HiFi Output Trans. **$5.00** Extra.

"COMPLETE RADIO KITS FROM $6.95"

DELUXE 5-TUBE AC-DC KIT OUR LEADER $9.95

Made from Detrola Components

A full size 5-tube superhet radio kit housed in a 13-inch wood cabinet with full plastic front. Lighted slide rule dial. Incorporates a standard 2 gang superhet circuit. Loop antenna, ready punched chassis, etc. This is another one of our line production radio kits. Every part is furnished including tubes, 12BA6, 12BF6, 12AT6, 50B5 and 35W4. Diagrams, photos and instructions are included. 5" dynamic speaker. Receives broadcast 550 to 1650 kc. Weight 9 lbs.

Kit Model TF-6C. Net $9.95.

4-TUBE T.R.F. KIT BARGAIN SPECIAL $6.95

4 tube AC-DC, TRF radio kit. Ideal for students and beginners. Every part furnished to build this kit, including tubes, diagram and photos. Has Alnico PM speaker and tubes. 12SK7, 12SJ7, 50B5 and 35W4. Plastic cabinet with airplane dial. Receives broadcast 550 to 1600 kc. This is the easiest type of radio to build. Kit Model TF-4. Weight 6 lbs. Net **$6.95.**

McGee's Theatre Quality AMPLIFIER KIT $34.95

Our sales and engineering department, realizing that not everyone can afford a $100.00 audio amplifier, has designed a Theatre quality, 15 watt True-Fidelity Amplifier kit. Response essentially flat, from 20 to 17,000 cycles. It contains every part, tubes and ready punched chassis. Has input for a crystal or dynamic microphone and gain and tone compensation for the new G.E. Variable Reluctance pickup, as well as the conventional crystal pickups. A 4 step tone switch for tone equalization. This kit has a 34 watt Merit high fidelity, wax impregnated output transformer, with 4, 8, 16 and 500 ohm taps. The chassis is of heavy treated metal, ready punched; approximately 5x11 inches. The quality of all parts is second to none. Priced complete with tubes as follows: 12AX7, 3—6C4, 2—6AQ5, and 5Y3. This is the best amplifier kit we know how to produce and we have made thousands. Kit Model ME-15R. Wt. 16 lbs. Net Price **$34.95.**

Altec 15" Coaxial Speaker Model 603B. **$63.00** Extra. (Pictured above Amp.).
Kit Model ME-34R. Similar to Model ME-15R except has push-pull 6L6 in Output. Giving up to 34 Watts of Audio. Weight 25 lbs.

GAROD PERSONAL RADIO KIT $14.95

Size 6½ x 3¼ x 4½—Weight 3½ Lbs.
Simple Assembly and Wiring Instructions

This kit is ready for immediate delivery. The same nationally known factory that manufactures tens of thousands of this radio, is line producing this radio kit for us. Every part, from the cabinet down to the last resistor, is matched. The chassis is ready punched; all you do is mount parts and wires. This radio kit will assemble into a beautiful personal radio for you, just the same as it does for the factory. We furnish you a diagram, photograph of the completed chassis and full assembly instructions so that those with a minimum knowledge of radio may wire this kit. The beautiful case is made of metal with plastic hinged lid and snap-on back. The lucite face of the receiver has an inlaid gold design. The circuit is the conventional two gang superhet type, with A.V.C. Receives the broadcast band 540 to 1650 KC. Uses miniature tubes: 1R5 converter, 1S5 detector A.V.C., 1T4 amplifier and 3S4 power amplifier. Alnico V PM speaker. The loop antenna is built in the lid. Radio comes on automatically when lid opens. Operates on self-contained batteries. Priced complete with tubes and 67½ volt "B" battery and flash cell (Not AC-DC). Nothing else to buy.
Model X45. Price $14.95 Include Postage for 6 lbs.
Scoop Model X-45 Personal Portable Kit Wired and Tested With Batteries. Net $17.95.

BUILD THIS 8-TUBE HI FIDELITY RADIO AND AMPLIFIER

• 8-INCH SLIDE RULE DIAL • RECEIVES BROADCAST and 19 to 49 METERS • PUSH PULL OUTPUT TUBES • BASS BOOST TONE CONTROL • EVERYTHING FURNISHED • CHASSIS SIZE 9½ x 11 x 8" HIGH • BEST RADIO KIT VALUE IN THE WORLD

8-Tube Kit $37.95

Here is something new in radio. A real 15 watt power amplifier with bass and treble controls. Has extra gain stage for crystal or dynamic mikes. And on the same chassis, a standard superhet radio receiver. We furnish all parts, knobs, escutcheon plate and tubes: 6SA7, 6SK7, 6SR7, 6SN7, 6SJ7, two 6V6 and 5Y3. No cabinet. Extra care in designing the power supply section assures low hum level, making this unit ideal for recording as well as P.A. use. We furnish everything as well as schematic diagram and photos of the completed chassis. Weight 26 lbs.
PRK-24. Radio-Amp. Kit with 12" P.M. speaker. With tubes.....Net **$29.95**
CPR-15. Exactly the same kit as the PRK-24 kit, except it is furnished with a 12" Cinaudagraph wide range speaker. (Has built-in high frequency tweeter.) This is our finest kit.....Net **$37.95**

BUILD A RADIO WITH MATCHED "DETROLA" PARTS 6-TUBE 2-BAND KIT $16.95

A complete kit of parts, tubes and ready punched chassis to build a fine 6 tube power transformer type radio chassis. (No cabinet.) We furnish every piece as well as a printed diagram and photograph. Chassis size 14x7½x7. Receives standard broadcast and 6 to 18 MC foreign short wave. 3 gang tuning condenser used on both bands. 90 mil power transformer. Push pull output type. Heavy duty 8 inch speaker. This set is made up of parts intended for use in a high quality Detrola radio. Has full lighted slide rule dial. Everything goes together just like a factory built radio. Priced complete with 6 tubes. Kit model 6-AC. Weight 16 lbs. net **$16.95.**

Kit model CD-8. Same basic design as the above model 6-AC except it is an 8 tube AC DC circuit with push pull 25L6 tubes in the audio. Weight 15 lbs. Priced complete with tubes net **$16.95.**
If you desire, we will sell just the chassis pan, slide rule dial, IF coils, RF and Ant coils and band switch for the model 6-AC kit. You supply all other materials. Diagram furnished. Stock No. B-14. Weight 7 lbs.....Net **$6.95**

COILS, IF'S—LOOPS

Universal slug tuned RF or ant coil for broadcast band.....	5 for **$1.49**
3 or 4 wire 456 osc. coil.....	**15c**
Matched sets of 456 IF coils, per set	**.98c**
Either input or outputs.....	**49c**
Small Medium or large loops.....	**39c**
Matched set. 2 gang cond. loop ant. osc. coil and 2 IF special...	**1.29**
Pee Wee 456 IF input or output...	**39c**

8-TUBE WIRE RECORDER REC. CHASSIS $35.95

Model 814 Chassis made for silvertone. 8 tubes, 12S0, 14Q7, 14A7, 7C7, 2—50A5, 2—35Y4. 5 inch slide rule dial. Chassis size 11x6x5½". 2 gang cond. receives standard broadcast. Tone control. Power trans. is mounted on small separate chassis to keep hum out of wire recordings. Input on chassis for mike and phono pick up. Built in osc. circuit for use with any wire recording mechanism. This chassis is from the famous silvertone radio wire recorder. Price includes chassis, tubes and 10 inch speaker. Weight 25 lbs. Model 814, net **$34.95.**

RECORD PLAYER KITS $9.95 AND UP

Capitol Portable Case

Deluxe Portable Record Player Kit housed in the attractive Capitol case. Includes all parts and easy to follow diagram. Has 4" Heavy Duty PM Speaker. 78 RPM Phono Motor. All necessary parts to build a 70L7 type Amplifier. Weight 14 lbs. Model CK-1. Net **$9.95.**

Portable Player Kit for L.P. $19.95

Complete Record Player with wired 4-T AC-DC Amplifier. Component parts shipped separately, 4x6" PM Speaker, Brown leatherette Capitol portable case with chrome trim case. Dual speed phono motor 33⅓ and 78 RPM. 2 Pickup Arms, LP & Standard. Only a few minutes required for assembly. A fine player to own. Stock No. LP-CC8. Net **$19.95.** Weight 17 lbs.

Model CC-8, same as above only for regular 78 RPM records only. Weight 18 lbs. Net **$14.95.**

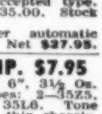
AC-PORTABLE PLAYER $19.95

Super deluxe record player with push-built 7C5 A C type amplifier and 6 inch speaker. All you do is mount amp. in the case. Case is of the accepted type. This player should sell for $35.00. Stock No. DL-3. Net **$19.95.**
Offered with Stewart-Warner automatic changer. Stock No. ARO-4. Net **$27.95.**

4-TUBE PHONO AMP. $7.95

4 Tube Phono Amplifier with 6", 3½ Oz. Alnico V PM Speaker. 4 Tubes, 2—35Z5, Voltage double, 12SQ7, and 35L6. Tone and Volume Controls. Small thin chassis. Made for a $1 mail order house. Plenty of power. Offered at less than production cost. Stock No. 5R-4. Weight 7 lbs. Net **$7.95.**

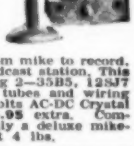
CHILDREN'S PLAYER KIT $7.95



New, children's electronic player. Offered in kit form. Includes all material necessary. Attractive red plywood cabinet, self-starting phono motor and crystal pick-up. 4x6" PM speaker and parts to build 70L7 amplifier. Diagram included. Weight 8 lbs. Stock No. LJ-1. Net Price **$7.95.**

1948 MODEL—MIKE-BROADCASTER KIT—ONLY $6.95

4-TUBES



Broadcasts 800 to 1500 KC from either a phonograph pick-up or a crystal or dynamic mike. Makes any radio receiver a P.A. system, record player or recording amplifier. Broadcast quality. Has fader control from mike to record, simulating a regular broadcast station. This is a powerful model: using 2—35B5, 12SH7 and 35W4. Priced with tubes and wiring diagram. Works on 110 volts AC-DC Crystal mike and desk stand **$4.95** extra. Complete Kit Model DE-4 truly a deluxe mike-phono oscillator. Weight 4 lbs.

$59.50 VALUE MUSICAL AMP. $24.95

8 watt Musical Amplifier. 4 tube AC transformer type. Proper gain for all instrument pickups. Housed in leatherette case with built-in 8" speaker. Gain and tone controls. Made by a large manufacturer, to sell for $59.50. Stock No. XR-3. Weight 25 lbs. Net Price **$24.95.**

SCOOP SALE ON RADIO CHASSIS; 6 TUBES, 3-WAY $14.95

Chassis Model 819-A. A deluxe broadcast 3-way 110 volt, AC or DC or battery pack radio chassis, complete with 6 tubes, 6" slide rule dial and 6" PM speaker. Size 12x6x7 inches. Made by a No. 1 manufacturer for a top mail order house. Has tuned RF stage; giving high sensitivity and selectivity. A $25.00 value for only **$14.95.**

5-TUBE BATTERY CHASSIS $10.95

Chassis Model 801. A broadcast 5 tube straight battery operated chassis. Requires 1½ volt A and 90 volts B. Similar in appearance to the model 819 pictured above. Size 12x5½x7". 6 inch slide rule dial. 3 tuned stages RF stage. Tubes 1LG5, 1LC6, 1LC5, 1LB4, 1LD5. Made for silvertone. Price includes chassis, tubes, a 6 inch PM speaker. Model 801, weight 12 lbs., net **$10.95.**

6-TUBE AC-DC CHASSIS $10.95

Model 808. A broadcast 6 tube AC-DC receiver made for silvertone. Size 5½x5½x10". 5 inch slide rule dial. 2 gang tuning cond. Tone control. 6 inch speaker. Similar to picture above. Ideal for utility use. Tubes 7B7, 14Q7, 7H7, 7C5, 50A5 and 35Y4. Chassis tubes and speaker weight 13 lbs. Scoop price **$10.95.**

5-TUBE AC-DC CHASSIS $9.95

5-Tube AC-DC chassis similar to the 6 tube set above. With tubes and 5 inch speaker. Receives standard broadcast. Weight 10 lbs. Net **$9.95.**

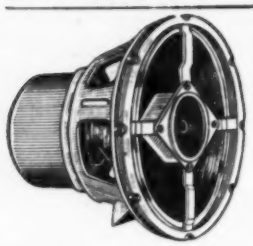
Chassis Model 825. A 9 tube transformer type AC chassis made for silvertone. Receives broadcast and FM, 88 to 108 MC. Size 11x8x8". 10 inch speaker. A ruggedly built receiver. Priced with tubes, 7F8, 7H7, 7C6, 7C7, 7C5, 7Z4, 7N7, 7W7, 7A6. An ideal chassis to replace those old model chassis. Weight 30 lbs. Chassis, tubes and speaker, model 825, net **$34.95.**

McGEE RADIO COMPANY

Order from This Ad. With Full Remittance Include Postage or May Be Sent Express Collect.

SEND 25% DEPOSIT — BALANCE C.O.D.
1225 McGEE ST., KANSAS CITY, MISSOURI

34 WATT "HIGH FIDELITY" OUTPUT TRANSFORMER $6.95



12 INCH COAXIAL P. M. MODEL CN-12X $10.95

Designed by one of America's finest speaker builders. Made for FM high fidelity radios, record players and P. A. systems. This speaker is incorporated in radios selling in the $500.00 bracket. It has an especially designed 12" 4.64 oz. Alnico V magnet PM for the low range and a coaxial built-in 3" Alnico V tweeter. The high pass filter is concealed under the pot cover. Just hook to any 8 ohm output transformer (will hook in place of any home radio speaker, as most speakers have an 8 ohm voice coil). Only 2 wires to connect, will handle 18 watts peak. Frequency response, 50 to 17,000 CPS. This coaxial PM speaker should sell for $35.00. Why buy an ordinary speaker, when we offer you the speaker of the future; for only **$10.95?**

Stock No. CN-12X. Weight 8 lbs. ..... **$10.95, 2 for $20.95**

DELUXE 12 INCH COAXIAL MODEL CR-13X $12.95

A regular $37.50 list speaker. The same basic design as the model CN-12X, described above, but furnished with 6.8 oz. magnet in the 12" woofer. Frequency response, 40 to 17,000 CPS. Has more mellow tone than CN-12X. Weight 9 lbs.

Model CR-13X ..... **$12.95, 2 for $24.95**

15 INCH SUPER HEAVY DUTY COAXIAL P. M. SPEAKER $24.95

"IT WOOFS AS IT TWEETS"

The King Coax. A 21.5 oz. 15 inch Alnico V PM speaker with a built-in high frequency tweeter. Will respond to from 40 to 12,000 cycles. This is a ruggedly built speaker with a curvelenter cone piece molded cone. Built-in high pass filter. Just hook to any 8 ohm output. Built by the maker of our ever popular 12 inch coax model CR-13X. This speaker has a retail list of over $60.00. We offer you our 5-15X 15 inch coax for only **$24.95.** Weight 22 lbs.

BASS REFLEX SPEAKER BAFFLE $24.95

6 Cubic Foot Utility Bass Reflex Speaker Baffle. Size 32x22x16. Heavy construction with curved pleasing lines. Celotex lining assures non-rattle reproduction. Finish is an attractive brown wrinkle paint. Chrome front trim. Specify when ordering whether for use with a 12"or 15" speaker. Weight 40 lbs. This is an ideal baffle for our deluxe Coaxial model CN-13X. Baffle Stock No. NA-12. Net **$24.95.** CN-13X 12" Coaxial PM Speaker and NA-12 Baffle both for **$34.95.** You will be pleased with the fine tone of this combination.

15" Theatre Twin Speaker $26.95

Our sound laboratory has assembled this fine speaker combination. A super heavy duty 15" Cinaudagraph Alnico V PM and a University Laboratories trumpet type high frequency tweeter. Ready cut plywood baffle and cut to fit grill cloth are furnished. All you do is bolt the speaker to the baffle and connect in the 4 Mfd. high pass filter. This combination will take 35 Watts of audio and frequency response 40 to 10,000 cps. A speaker combination of theatre quality. Stock No. BW-3L. Net Price..... **$26.95**

5 NATIONALLY KNOWN 12" P.M. SPEAKERS ONLY $22.50

Nationally known 12" 6.8 oz. Alnico V PM with 1" 8 ohm voice coil. Will take 15 watts. Grey finish. Our leading 12" speaker.
Stock No. CH-12. Net **$4.95.**
5 for **$22.50**
12" 12 Oz. Mag. Will Take 20 Watts $8.95
Super heavy duty 12" 12½ oz. Alnico V magnet PM with 1¼" with 8 ohm voice coil. This speaker is equal to 60 oz. of old type magnet. Will take 25 watt peak. Stock No. CH-13—**$8.95;** two for **$17.00**

McGEE HAS THE SPEAKERS

Following speakers listed are latest production No-Factory throwouts made by the largest factory who furnish the original equipment to America's biggest Radio Factory. Every speaker guaranteed.

3" PM 1 Oz. Alnico 5 Magnet	$0.99
4" PM 1 Oz. Alnico 5 Magnet	.99
4" PM 1½ Oz. Alnico 5 Magnet	1.19
5" PM 1 Oz. Alnico 5 Magnet	.99
5" PM 1½ Oz. Alnico 5 Magnet	1.19
6" PM 1½ Oz. Aln. 5 Mag., Square	1.49
6" PM 2.15 Oz. Aln. 5 Mag. Square	1.98
6" PM 3.16 Oz. Aln. 5 Mag., Square	2.49
6½" PM 1.5 Oz. Aln. 5 Mag., Round	1.69
4x6" PM 1.5 Oz. Alnico 5 Magnet	1.49
6x9" PM 3.16 Oz. Alnico 5 Magnet	2.98
6x9" 7 Oz. Alnico V PM	3.49
7" PM 3.16 Oz. Alnico 5 Magnet	2.98
8" PM 3.16 Oz. Alnico 5 Magnet	2.98
10" PM 4.64 Oz. Alnico 5 Magnet	3.98

Hot Buys In PM's—With Trans.

4" PM 1 Oz. Aln. 5 2500 Ohm Trans.	$1.49
4" PM 1 Oz. Aln. 5 10M Ohm Trans.	1.49
5" PM 1 Oz. Aln. 5 2500 Ohm Trans.	1.69
5" PM 1 Oz. Aln. 5 10M Ohm Trans.	1.69
5½" PM 1 Oz. Aln. 5 2500 Ohm Trans.	1.89
6" PM 1.5 Oz. Aln. 5 7000 Ohm Trans.	1.99
6" PM 1.5 Oz. Aln. 5 2500 Ohm Trans.	1.99
6" PM 2.15 Oz. Aln. 5 7000 Ohm Trans.	2.49
6" PM 3.16 Oz. Aln. 5 10M Ohm Trans.	2.98

Hot Buys In Field Spkrs. With Trans.

5" 450 Ohm with 2500 Ohm Trans.	$1.98
5" 450 Ohm with 7000 Ohm Trans.	1.98
6" 1500 Ohm with 7000 Ohm Trans.	2.29
8" 450 Ohm with 7000 Ohm Trans.	2.98
8" 1000 Ohm, Less Trans.	2.49
10" 1000 Ohm, Less Trans.	3.98
12" 450 Ohm RCA, Less Trans.	4.98
12" 1000 Ohm Magnavox, Less Trns.	4.98

Famous Magnavox Speakers

6" Auto Speaker—4 Ohm	$2.49
7" Auto Speaker—4 Ohm	2.98
8" Auto Speaker—4 Ohm	2.98
5" 8 Oz. Alnico 3 PM	1.79
8" 12 Oz. Alnico 3 PM	2.98
10" 21 Oz. Alnico 3 PM	4.98
12" 21 Oz. Alnico 3 PM	5.98

Save Up To 50% On Cinaudagraph Field Coil Speakers

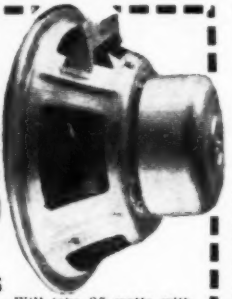
Regular Dealers Stock of field type Cinaudagraph Replacement speakers. Brand new, individually cartoned. Don't pass up this value.

3" 450 Ohm Field Cinaudagraph	$1.79
4" 4 Ohm Field (Auto) Cinaudagraph	1.79
4" 450 Ohm Field Cinaudagraph	1.79
5" 4 Ohm Field (Auto) Cinaudagraph	1.79
6" 450 Ohm Field Cinaudagraph	1.99
6" 1000 Ohm Field Cinaudagraph	1.99
8" 1000 Ohm Field Cinaudagraph	2.49

HOT ITEM—AUTO SPEAKERS

MAGNAVOX	UTAH
6" Square 4 OHM	$1.49
6½" Round 4 OHM	1.49
6x9" Auto Speaker 4 OHM	1.98
7" Motola-Philco	2.49
8" Motola-Philco	2.49

BRAND NEW 1949 PRODUCTION 15 INCH PERMANENT MAGNET SCOOP OF ALL TIMES NEW MOLDED CONE



Pre-War or Post-War, you never bought a speaker like this for such a scoop price. Made by a nationally known builder of fine speakers. A full 15" 12½ oz. Alnico V magnet speaker of juke box quality. Has standard 8 ohm voice coil. Will take up to 18 watts average or 25 watts peak. Here is a speaker that will bring out those low notes. Latest 1948 production; not line through-outs. Every speaker is guaranteed new and perfect. We may not be able to continue this offer for long, so place your order now Stock No. 15-KR. INCLUDE POSTAGE Wt. 11 lbs. A $35.00 value for only **$9.95**

15" DELUXE 50 WATT P.M. SPEAKER $16.95

Model 15-LS. 15" 21½ oz. Alnico V Magnet PM Speaker. Will take 35 watts with ease. Thousands of dollars were spent in building the fine tools to produce this speaker. The 8 ohm voice coil is 1½" in diameter and has been heat treated and plastic coated. Constructed to eliminate loose voice coils, wires and wrapping. Made by a renowned builder of fine speakers. Truly the King of juke box speakers. Weight 18 lbs. Net Price **$16.95,** 2 for **$32.95**

50 WATT 12 INCH SUPER HEAVY DUTY P.M. $14.95

Model A-50—12", 50 watt super heavy duty permanent magnet speaker. Has 1½" 8 ohm treated voice coil and one piece molded cone. Heavy half inch machined pot, with bolt secured 21 oz. Alnico V magnet. Frame is of heavy construction with metal pot cover. Finished in silver-grey enamel. This speaker is the best value possible today. Efficiency is two to three times that of ordinary speaker. Especially recommended for all public address systems and high quality home audio systems. Will handle 35 watts with ease, and 50 watts peak or short lengths of time. Its retail value is $50.00. But, by our large purchase, we are able to offer it to you for only **$14.95.** Do not confuse this speaker with surplus merchandise. This is the latest production. Model A-50. Weight 15 lbs. Net **$14.95,** 2 for **$29.00**

100 RADIO TUBES $29.95

250,000 Tubes for fast sale. Tremendous value. Tubes up to $3.00 list. 100 Cartoned and branded Hyvac Miniature Tubes for $29.95. Over a million sold. Guaranteed full replacement. 34c Each in smaller quantities.

1A5	12BA6	12AX7	6AU6	6BF6
1T4	12BE6	19T8	6BJ6	6AU7
1U5	35W4	12AU6	6BA6	6AJ5
3A4	50B5	12BF6	6BE6	6SU7
1S5	35B5	117Z3	6AT6	6AQ6
3V4	12AT7	6A6G	6C4	12AT6
3Q4	12AU7	6BH6	6AL5	
3S4	12BA7	6X4	6AQ5	

34c each
100 for $29.95

Popular GT Tubes, individually cartoned and branded Hyvacs. $35.00 per hundred. 39c Each in smaller quantities.

6V6	6X5	6SK7	12SF7	12SN7	
6SN7	6SD7	6SQ7	6J5	12BF7	
6C5	5Y3	25L6	6SJ7	6SL7	
6P5	6K7	70L7	12SJ7	35Z5	
12A8	6Y3	1B4	6SF5		
6S8	6K6	12K8	80		
12S8	6SA7	12A6			

39c each
100 for $35.00

HYVAC 6AK5 AND 6J6 59c EACH

STANDARD BRAND G.T. TUBES CARTONED and UNCARTONED 49c

12AH7	6J6	6SJ7	12BE6	1S5	7N7	6A3	oE5	1G6
27	6K7	6SK7	12H6	7B6	35Z5 GT	483	38	1B5
2e	9001	6SL7	12J5 GT	7A7	35W4	2051	39	1E5
78	9002	65G7	7H7	6R7	50B5	25Z5	89	1F5
7e	9003	6SN7	7C7	6L7	2525	6B4	6SS7	1B4
3S4	1625	7E5	12SG7	7Z4	2526	6C4	7A5	1H6
5U4G	6SA7	7E7	12SH7	12SQ7	6D6	78	12FS7	12C8
5Y3G	14Q7	6SR7	12SJ7	12SR7	6C6	7Y4	7V7	6V4
6AC7	14B6	6V6 GT	12SA7	50L6	6J7	14C7	6Y6	36Y4
35Y4	6SC7	6X5 GT	12SL7	12SK7	77	14R7	30	
14A7	6SF7	6AB7	12SC7	25L6 GT	7C5	35B5	32	
6C5	6SQ7	12AT6	1T4	35L6 GT	7Z4	12BD6	33	
6H6	6SH7	12BA6	1R5	7F7	6K5 GT	6F5 GT	1J6	

NAME BRAND 1½ VOLT LOCTALS, ETC.

1LN5	1LD5	1LH4	1LC6	1LA6	1LB4	69c	10 for $6.50
1LC5	1LG5	3LF4	1LE3	1LA4	——		
1A7	1H5	1A5	1N5	3Q5	1T5	69c	10 for $6.50
1Q5	1P5	1C5	1G4	1G6	117Z6		

0Z4 **69c Each, 100 for $59.50**
35A5 50A5 **69c Each.**

6L6 METAL 99c

NEW WIRE RECORDER MECHANISM $22.95

$75.00 LIST

BRAND NEW. ADAPT ANY RADIO OR AMP TO RECORD ON WIRE

Brand new Wire Recorder. Play back mechanism. Same as those used on the majestic radio wire recorder. This unit has 78 RPM Turntable for recording on wire from a phono record. Records up to 1 Hour on standard Webster Recording Wire. This wire recording mechanism is offered to you at a fraction of the regular net. Space required 9x13x3½ below board. Each unit is furnished with Oscillator Coil and a diagram to show how to wire a 5-Tube Osc. (We furnish special Osc. coil not small parts for Oscillator) and how to adapt the wire recorder to any radio or amplifier. Ready punched for crystal phono pick up. Majestic Wire record head with Osc. Coil and diagram. Stock No. X93, weight 15 lbs. Net **$22.95.**

Crystal Pickup Arm for Playing 78 RPM record **$2.95** extra. Webster Recording Wire. 15 Min. **$1.30,** 30 Min. **$1.95,** 1 Hr. **$3.25.** Bullet Stand Shure Crystal Mike **$4.95.**

MAJESTIC RADIO CHASSIS AND WIRE RECORDER $49.95

Majestic Broadcast 5-Tube AC-DC Radio Chassis with slide rule dial, 6" Speaker with separate 2-Tube Recorder osc-amplifier and switching arrangement to record from radio stations, mike, or play and record 78 RPM phono recorders. This is the whole majestic Wire Recording radio completely built, less cabinet. A terrific value, only 200 to sell. This is the most radio wire recording merchandise we have ever offered for the money. You get Majestic Chassis, Wire recording and play back mechanism, X-tal Mike, 15 Min. Spool Wire, Crystal Pickup. All wiring is done. Just plug unit together and follow instructions. Weight 30 lbs. Stock No. MAJ-R7. Net **$49.95.**

OUTPUT TRANSFORMER HIGH FIDELITY 20—20,000 C.P.S. SCOOP PRICE $6.95 EACH

Why pay $20.00 or $30.00 for an output. Supreme quality and high fidelity output transformer. Designed to match push-pull plates (2—6L6, 2—6V6, or 2—6AQ5) class AB, to 4-8-15-250 and 500 ohm; with 100% feedback winding. Housed in a compound filled case; 3½x4½ x3". Actual net weight, 6 lbs. If you want the best quality from your audio system, order this transformer. Response essentially flat from 20 to 20,000 cycles. We have tried several high fidelity outputs in our lab and find this to be the best value. Even though your amplifier only puts out 10 or 15 watts, this 34 watt job is what you should have. Connecting instructions are furnished. Stock No. A-403, shipping weight 8 lbs. Net price **$6.95**

Our Leader Magnetic Tape Recorder

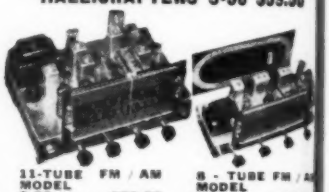
$250 List—Net $149.50

Magnetic tape recorder of nationally known manufacturer, complete ready to operate. Has AC transformer type amplifier for recording and playback. Housed in an attractive leatherette case, with microphone. Makes a 30 minute recording from standard magnetic tape. Made to sell for $250.00 list. McGee's scoop price **$149.50.** Circular sent on request.

GENERAL ELECTRIC AND WEBSTER VARIABLE RELUCTANCE

New Webster cartridge with removable permanent needle. Response is second to none. Offered with preamplifier (6ac7) ready wired and tested. A scoop at **$5.95** complete.
Webster MI-VR cartridge only, net .. **$4.**
New General Electric V. R. cartridge No. RPX-040, with removable needle. Net ..... **$5.**
General Electric V. R. cartridge RPX-041 for micro-groove records. Net ..... **$5.**
Our 6ac7 type pre-amplifier with either PRX-040 or PRX-041 cartridge. Net **$7.**

HALLICRAFTERS S-56 $59.50



11-TUBE FM / AM MODEL	8 - TUBE FM / AM MODEL
S-56 ..... $59.50	S-59 ..... $39.50

Hallicrafter S-56, 11 Tube AM/FM Chassis (AFC on FM.) A regular $110.00 Chassis. New factory Cartoned with tube. Only a few sets left. Weight 25 lbs. Net **$59.50.**
500 Ohm to Voice Coil Speaker matching Transformer **$2.50.**
Hallicrafter S-59, 8 Tube AM/FM Receiver Chassis. Has push-pull 6K6 Audio. A real value while our 100 Chassis last. Weight 16 lbs. With tubes. Net **$39.95.**
500 Ohm to Voice Coil Speaker matching Transformer **$2.50.**
Speakers recommended for S-56 & S-59, CR-13X, 5-15X or A-50, advertised on this page.

Tape Recorder Mechanism $59.50

Brush Magnetic tape recorder-player mechanism as used on the famous Brush recorder. Furnished with a diagram of tape recorder. Weight 20 lbs. 30 minute spools of Scotch recording tape **$2.50.**

TELEVISION CHASSIS SCOOP $59.95

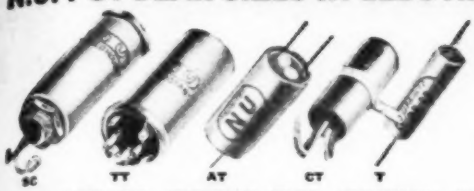
Farnsworth Television Chassis Model GVZ60 partially built up Chassis 12x17. Has 17 Tube sockets and 150 small parts (Resistors and Ceramic Condensers) no coils or Transformers or tuning unit. Sweep and sync circuits are all partially wired up. This T.V. Chassis is ideal for the student and experimenter. Learn T.V. by building your own set using this chassis to start from. Furnished with a 1948 regular $3.00 Supreme Publications Television Manual, which has a complete schematic of this chassis as well as 9 pages of service information.
If you want to play with Television here is a chance to get started.
Farnsworth GVZ60 partially built up Chassis and 48 Supreme T.V. Manual all for $5.95. Include postage for 10 lbs. GVZ60 Chassis only **$2.95.**

McGEE RADIO COMPANY

Order from This Ad. With Full Remittance Include Postage or May Be Sent Express Collect

SEND 25% DEPOSIT — BALANCE C.O.D.
1225 McGEE ST., KANSAS CITY, MISSOURI

N.U. POPULAR SIZES IN ELECTROLYTICS—25c UP • VOLUME CONTROLS 24c UP



SALE! NATIONAL UNION

ORDER $100.00 WORTH OF N.U. COND.—TAKE 10% OFF

100,000 FOR SALE AT OVER ½ SAVING. PLENTY OF EACH SIZE.

We bought the entire stock of National Union Electrolytics, Tubular By-passes, and Sav-A-Shaft Volume Controls. Stock up now while pickings are good. All National Union Condensers offered by us are late 1948 production by a Number One builder of Electrolytics. Guaranteed by us for a period of one year. You must be satisfied with the merchandise we ship you. Order $100.00 worth of these N. U. Condensers and take 10% off of price.

TYPE "AT" N.U. TUBULAR ELEC. ALUMINUM WITH SEALED ENDS

National Union Type AT Electrolytics. Housed in sealed metal tubes in spun-end cardboard sleeves. Bare wire leads. Standard package of 10 condensers. Save over half. This is your every day need in condensers. One-year guarantee.

AT 10 MFD.	25 Volt	11/16x1¾"		15c
AT 25 MFD.	25 Volt	11/16x1¾"		20c
AT 50 MFD.	25 Volt	11/16x1¾"		20c
AT100 MFD.	25 Volt	11/16x1¾"		25c
AT 5 MFD.	50 Volt	11/16x1¾"		10c
AT 10 MFD.	50 Volt	11/16x1¾"		15c
AT 25 MFD.	50 Volt	11/16x1¾"		20c
AT 50 MFD.	50 Volt	11/16x1¾"		20c
AT100 MFD.	50 Volt	11/16x1¾"		25c
AT 4 MFD.	150 Volt	11/16x1¾"		10c
AT 8 MFD.	150 Volt	11/16x1¾"		15c
AT 12 MFD.	150 Volt	11/16x1¾"		20c
AT 16 MFD.	150 Volt	11/16x1¾"		25c
AT 20 MFD.	150 Volt	11/16x1¾"		25c
AT 24 MFD.	150 Volt	13/16x1¾"		25c
AT 30 MFD.	150 Volt	13/16x1¾"		30c
AT 40 MFD.	150 Volt	13/16x1¾"		30c
AT 50 MFD.	150 Volt	15/16x1¾"		35c
AT 80 MFD.	150 Volt	15/16x2⅛"		35c
AT 8 MFD.	250 Volt	11/16x1¾"		20c
AT 12 MFD.	250 Volt	13/16x1¾"		25c
AT 20 MFD.	250 Volt	13/16x1¾"		25c
AT 24 MFD.	250 Volt	13/16x1¾"		25c
AT 30 MFD.	250 Volt	15/16x1¾"		30c
AT 40 MFD.	250 Volt	15/16x1¾"		30c
AT 4 MFD.	450 Volt	13/16x1¾"		20c
AT 8 MFD.	450 Volt	13/16x1¾"		30c
AT12 MFD.	450 Volt	15/16x2⅛"		35c
AT16 MFD.	450 Volt	15/16x2⅛"		40c
AT20 MFD.	450 Volt	15/16x2⅛"		40c
AT30 MFD.	450 Volt	1-1/16x2⅛"		45c
AT40 MFD.	450 Volt	1-1/16x2⅝"		50c
AT16 MFD.	525 Volt	1-1/16x2⅛"		45c

DUAL SECTION COMMON NEG.

AT 8-8 MFD.	150 Volt	13/16x1¾"		20c
AT16-16 MFD.	150 Volt	13/16x1¾"		25c
AT20-20 MFD.	150 Volt	13/16x1¾"		30c
AT30-30 MFD.	150 Volt	15/16x2⅛"		35c
AT40-20 MFD.	150 Volt	15/16x2⅛"		35c
AT40-40 MFD.	150 Volt	15/16x2⅛"		40c
AT50-30 MFD.	150 Volt	15/16x2⅛"		50c
AT50-50 MFD.	150 Volt	15/16x2⅛"		50c
AT80-40 MFD.	150 Volt	1-1/16x2⅛"		60c
AT 4-4 MFD.	450 Volt	15/16x2⅛"		25c
AT 8-8 MFD.	450 Volt	15/16x2⅛"		40c
AT10-10 MFD.	450 Volt	15/16x2⅛"		40c
AT 8-16 MFD.	450 Volt	1-1/16x2⅛"		45c
AT16-16 MFD.	450 Volt	1-1/16x2⅝"		50c
AT20-20 MFD.	450 Volt	1-1/16x2⅝"		60c

TYPE "CT" ELECTROLYTICS DUAL TUBULAR BANKS

National Union Type CT Cardboard tubular with wax seal and mounting strap. Flexible leads. Individually cartoned in green N.U. boxes. A red hot value at over ½ saving. One-year guarantee.

CT16-16 MFD.	150 Volt	⅞x2⅜"		25c
CT20-20 MFD.	150 Volt	⅞x2⅜"		30c
CT30-30 MFD.	150 Volt	1 x2⅜"		35c
CT40-20 MFD.	150 Volt	1 x2⅜"		35c
CT40-40 MFD.	150 Volt	1 x2⅜"		40c
CT50-30 MFD.	150 Volt	1 x2⅜"		50c
CT80-40 MFD.	150 Volt	1 x2⅜"		60c

DUAL SECTION 4-LEADS

16-16 MFD.	150 Volt	1x2⅜"		30c
20-20 MFD.	150 Volt	1x2⅜"		35c

N.U. 600-VOLT TUB. BY-PASSES

National Union attractive green paper 600 Volt Tubular Condensers. Super sealed, wax filled, rigid tinned leads. Save ⅓ on these. All 1-year guarantee. Order 100 assorted, you pick size, for **$6.95.**

T.001	MFD. 600 Volt	3/8x1-3/16"	5c
T.002	MFD. 600 Volt	3/8x1-3/16"	5c
T.006	MFD. 600 Volt	3/8x1-3/16"	5c
T.03	MFD. 600 Volt	7/16x1-5/8"	6c
T.04	MFD. 600 Volt	7/16x1-5/8"	6c
T.1	MFD. 600 Volt	1/2x1-5/8"	6c
T.25	MFD. 600 Volt	5/8x1-3/4"	8c
T.50	MFD. 600 Volt	3/4x2"	10c
T.75	MFD. 600 Volt	1x2"	15c

N.U. THREAD MOUNT ALUMINUM CAN TYPE SC

National Union Type SC-SCN-SCS Upright Aluminum Can Condensers. With pal nut mounting. Flexible insulated leads. Individually cartoned in green N.U. boxes. Save over half on this. One-year guarantee.

SC 4 MFD.	450 Volt	1⅜x3½"		25c
SC 8 MFD.	450 Volt	1⅜x3½"		30c
SC12 MFD.	450 Volt	1⅜x3½"		35c
SC16 MFD.	450 Volt	1⅜x3½"		40c
SC20 MFD.	450 Volt	1⅜x3½"		45c
SC30 MFD.	450 Volt	1⅜x3½"		50c
SC40 MFD.	450 Volt	1⅜x3½"		50c
SC 8 MFD.	525 Volt	1⅜x3½"		50c
SC16 MFD.	525 Volt	1⅜x3½"		60c
SC 4 MFD.	600 Volt	1⅜x3½"		35c
SC 8 MFD.	600 Volt	1⅜x3½"		60c
SC12 MFD.	600 Volt	1⅜x3½"		70c
SC16 MFD.	600 Volt	1⅜x3½"		80c

SCN—DUAL—COMMON NEG.

SCN 8-8	MFD.	450 Volt	1⅜x3½"	50c
SCN 8-16	MFD.	450 Volt	1⅜x3½"	55c
SCN16-16	MFD.	450 Volt	1⅜x3½"	60c
SCN20-20	MFD.	450 Volt	1⅜x3½"	70c

SCS DUAL FOUR LEADS

SCS 8-8	MFD.	450 Volt	1⅜x3½"	50c
SCS 8-16	MFD.	450 Volt	1⅜x3½"	55c
SCS16-16	MFD.	450 Volt	1⅜x3½"	60c
SCS20-20	MFD.	450 Volt	1⅜x3½"	70c

NATIONAL UNION ALUMINUM CAN "TWIST TAB" TYPE TT

National Union Type TT Electrolytic Condensers. Aluminum can F.P. type Twist Tab mounting common negative grounded to can. Individually cartoned in green N.U. boxes. Each condenser supplied with 1 bakelite insulating plate and 1 metal grounding plate. Save over half on these. All sizes and one-year guarantee.

TT 100 MFD.	25 Volt	1x2-1/16"		19c
TT 250 MFD.	25 Volt	1x2-1/16"		19c
TT 10 MFD.	450 Volt	1x2-1/16"		25c
TT 20 MFD.	450 Volt	1x2-1/16"		30c
TT 30 MFD.	450 Volt	1x3⅛"		40c
TT 40 MFD.	450 Volt	1x3⅛"		50c
TT 80 MFD.	450 Volt	1⅝x3"		60c
TT 20-20 MFD.	150 Volt	1x2-1/16"		30c
TT 30-20 MFD.	150 Volt	1x2-1/16"		35c
TT 40-40 MFD.	150 Volt	1x2-1/16"		40c
TT 50-30 MFD.	150 Volt	1x2-1/16"		45c
TT 50-50 MFD.	150 Volt	1x2-1/16"		50c
TT 80-40 MFD.	150 Volt	1x3⅛"		60c
TT 10-10 MFD.	450 Volt	1x2-1/16"		40c
TT 16-16 MFD.	450 Volt	1x3⅛"		45c
TT 20-20 MFD.	450 Volt	1x3⅛"		50c
TT 40-40 MFD.	450 Volt	1⅝x3"		60c
TT 40-40 MFD.	150 Volt	25 MFD. 25 Volt	1x2-9/16"	40c
TT 20-20-40 MFD.	150 Volt	1x2-9/16"		50c
TT 40-20-20 MFD.	150 Volt	1x2-9/16"		60c
TT 40-40-40 MFD.	150 Volt	1x3⅛"		60c
TT 50-50 MFD.	150 Volt	25 MFD. 25 Volt	1x2-9/16"	50c
TT 80-40 MFD.	150 Volt	25 MFD. 25 Volt	1x3⅛"	60c
TT 10-10 MFD.	450 Volt	20 MFD. 25 Volt	1x3⅛"	50c
TT 10-10-10 MFD.	450 Volt		1x3⅛"	60c
TT 16-16-16 MFD.	450 Volt		1⅝x3"	65c
TT 20-20-20 MFD.	450 Volt		1⅝x3"	65c
TT 10-10-10 MFD.	450 Volt	20 MFD. 25 Volt	1⅝x2"	70c
TT 10-10-10-10 MFD.	450 Volt		1⅝x2"	70c

100 N.U. SAV-A-SHAFT $29.95

National Union Sav-A-Shaft Volume Controls. A regular $1.25 list item all individually cartoned with instructions. Every size Control is equipped with an off-on switch which may be used by pulling small tab. These Controls are handy as most of you radio service men know. For replacement merely saw off old Volume Control Shaft and drive into the National Union Sav-A-Shaft coupling. Pick the sizes you want at these dollar saving prices or just order one hundred, as we assort them for only **$29.95.**

NU 5M-A	5,000 OHM		24c
NU 10M-B	10,000 OHM		24c
NU 25M-A	25,000 OHM		24c
NU 50M-B	50,000 OHM		29c
NU 100M-B	100,000 OHM		29c
NU 250M-TX	250,000 OHM	Tapped	29c
NU 500M-TX	500,000 OHM	Tapped	39c
NU 1 MEG-TX	1 MEG OHM	Tapped	39c
NU 2 MEG-TX	2 MEG OHM	Tapped	39c
NU 500M-CB	500 MEG		39c

100 National Union Controls **$29.95.** Assorted as follows: 25 of the 1st 3 Types, 25 of the 2nd 3 Types, and 50 of the last 4 Types.

CRYSTAL CARTRIDGES

WE HAVE 'EM, $1.39 AND UP

EVERY XTAL GUARANTEED

Astatic MLP-1 $1.39, 10 for $12.50

Astatic MLP-1 Cartridge with permanent needle. This model used on many original equipped changers. Priced at below cost of needle. **$1.39;** 10 for **$12.50.**

Astatic MLP-2, same as MLP-1, only later model with QT needle. No surface noise. Sale price, **$1.95.**

Astatic NJ-Nylon cartridge with permanent, but changeable needle, **$3.29.**

Astatic QT 3-M cartridge with silent needle response to 10,000 CPS. Reg. $8.40 List. Scoop price, **$3.29.** Shure TN305 or TO305 Cartridges with needle, **$2.49.**

Astatic LTM Cartridge with needle. Scoop price, **$2.49.**

Plastic arm with 3 V. cartridge, **$1.95.** Complete arm with 3½ V. cartridge, **$2.29.**

Complete arm with 1V. cartridge, **$2.29.** L.P. micro-groove arm with needle, **$3.95.**

Webster M1 Variable Reluctance Cartridge. Swell size with replaceable needle, **$4.41.**

3 Cartridges—95% Off Your Need

$1.79 Each, 10 for $15.00

Astatic L-40 or equal, with rest clip, replaces the following: L-41, L-75, Webster C-5, E-9, F-3, N-3, N-5, or N-7. **$1.79** each: 10 for **$15.00.**

Astatic L-70 or equal, with rest clip. Replaces the following: L-22, L-26, L-27, L-71, L-76 or Shure: P-88, P-89, W-40, W-50 or Webster, 1X5, 1X2, N-4, E-4, etc. **$1.79** each: 10 for **$15.00.**

Astatic L-72 or equal, with rest clip. Replaces the following: L-24, L-46. Shure P-89 and Webster, N10P5 a 3 Volt Output that will drive single tale record players and put extra power in any player. The most universal crystal built. **$1.79** each: 10 for **$15.00.**

CALTRON V.R. CARTRIDGE, $2.95

Caltron Variable Reluctance Standard size cartridge as used in broadcast stations. Has permanent needle. A $15.00 cartridge for only **$2.95.**

GE Variable Reluctance Cartridge RPX-040 with replaceable needle **$5.85.**

GE RPX-041 1 Mill Micro-Groove **$5.85.**

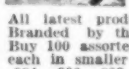
SAVE ½ ON THESE "NAME BRAND" COND.

CAN TYPES—TUBULAR ELECTROLYTICS & BY-PASSES

ELECTROLYTICS UPRIGHT ALUMINUM CANS

Save half on these genuine aluminum can upright screw mounting. Fresh Stock One year guarantee.

RS213	8 mfd. 450V.	1 x2⅜"	$0.49
RS215	12 mfd. 450V.	1 x2⅜"	.54
RS223	30 mfd. 450V.	1⅜x3"	.59
RS262	8x8 mfd. 450V.	1⅜x3¾"	.59



Nationally Famous 600 Volt Tubulars

All latest production 600 volt tubulars Branded by their makers as type T.P. Buy 100 assorted for only **$6.95**—8 cents each in smaller quantities, .04, .06, .02, .004, .006, .008.

1600 volt rated for the tough job or auto buffers. .002, .02, .04, .05, 15c each; 10 for **$1.29.**

Solar Wet Electrolytics

Genuine Solar Screw Mounting Wet Electrolytics. Latest 1948 production. Use Solar wets when you want a filter for those tough jobs.

8 mfd. 500 Volt wet.	Solar		$0.87
16 mfd. 500 Volt wet.	Solar		1.23
20 mfd. 500 Volt wet.	Solar		1.32
8 mfd. 600 Volt wet.	Solar		1.32
16 mfd. 600 Volt wet.	Solar		1.80

PHILCO Dynamic Mike $9.95

Regular $26.50 list Philco High Imp. Dynamic Mike and Cable. Same as Electrovoice Model 903. Net **$9.95.**

33X Crystal Mike with 20 Ft. of Cable. Net **$10.95.**

33D High Frequency Dynamic Mike with 20 Ft. of Cable. Net **$12.95.**

Crystal Recording Mike with Desk Stand **$4.95.**

STANDARD 4-PRONG VIB., $1.29

Standard Auto replacement heavy duty regular size, **$1.29** each, 10 for **$11.95.**

Every Vibrator Guaranteed Best Values in U. S.

Replacement sync vibrator unit	$0.99
Standard 5 prong sync vibrator	1.49
6 prong, reversible sync vibrator	1.99
7 prong reversible sync vibrator	1.99
7 prong, 2 volt G.E. vibrator	1.99
4 prong, off-set Delco vibrator	1.49
5 prong sync vibrator	1.49
4 prong vibrator for Ford	1.49

ELECTROLYTICS EVERY DAY REPLACEMENTS

Type TCS Aluminum tubes with paper insulating tubes. Separate sections with lugs. Buy a good supply of these at over half off. Fresh stock. One year guarantee.

TCS45	20x20	mfd. 150V.	1x2⅜"	$0.39
TCS47	30x30	mfd. 150V.	1x2⅜"	.44
TCS48	40x40	mfd. 150V.	1x2⅜"	.49
TCS52	10x10	mfd. 250V.	1x2⅜"	.29
TCS55	20x20	mfd. 250V.	1x2⅜"	.34
TCS71	8x8	mfd. 450V.	1x2⅜"	.49
TCS74	15x15	mfd. 450V.	1x2⅜"	.59

Type TCD Dual with Common Neg. and 3" Leads.

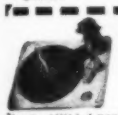
TCD55	20x20	mfd. 250V.	1x2"	$0.34
TCD52	10x10	mfd. 250V.	1x2"	.29
TCD65	20x20	mfd. 350V.	1x3"	.34

ST, 2N, 38, 48. Cardboard Tubes, Mallory Built, with metal tabs for vertically or under chassis mounting. Fresh Stock. One year guarantee.

ST595	8 mfd. 450V.	⅝x2½"		$0.29
ST597	16 mfd. 450V.	1x2¾"		.39
ST598	20 mfd. 450V.	1x2¾"		.44
ST599	30 mfd. 450V.	1x3¼"		.49
2N569	20x20 mfd. 150V.	⅞x2⅜"		
2N518	8x8 mfd. 450V.	1x2¾"		.49
2N556	30x30 mfd. 150V.	1x2¾"		.44
3N533	30x30 mfd. 150V.	20x25V.		.54
3S579	8x8 mfd. 450V.	20x25V.		
		1⅛x2⅞"		.54
3S584	8x8x8 mfd. 450V.			
		1⅝x2⅞"		.69
4S718	8x8 mfd. 450V.	10x10"		
		25V. 1⅝x2⅞"		.59

15 inch P.M. 6 Lb. Mag. Jensen $26.95

A 15 PM. A fine 15 Inch Permanent Magnet Speaker. Heralded by some connoisseurs of fine musical reproduction as the world's finest speaker. Brand new original cartons. 6 Pound Alnico 3 Magnet. 1½ Inch 8 Ohm Voice Coil. One piece molded cone made by Jensen. A regular $55.00 list price for only **$26.95.** Two for **$50.00.** Weight 22 lbs.



CRESCENT DELUXE CHANGER ONLY $14.95

Made 400A Crescent Deluxe 78 RPM Automatic Changer with shure cartridge. Shuts off on last record. Base size 11½x13½". Deep maroon finish. Weight 11 lbs. Scoop price **$14.95**

Aero 78 RPM Automatic Changer with Q.T. Cartridge and permanent needle. Base size 12x13". Scoop price **$12.95.**

Two for **$24.95**

VM-800 78 RPM Automatic Changer. Base size 13¼x14". A wonderful buy at **$12.95.** Two for **$24.95**

Farnsworth 78 RPM 2-Post Automatic Changer with new variable reluctance cartridge. Net **$19.95**

VM-400 78 RPM Automatic Changer. Intermixes 10" and 12" records. Space required 12¼x13". A Scoop at only **$19.95**

Triple Post 78 RPM Seeburg Automatic Changer. Super construction. Intermixes 10" and 12" records. Base size 14½x14". Price **$29.95**

Popular Detrola Changer **$12.95**

General Instrument 78 RPM Automatic Changer. A fine small changer. Base size 10½"x12". Net **$14.95**

Leatherette made to fit bases for any of the above changers **$1.95** each.

WEBSTER DUAL-SPEED

World famous Webster Chicago model 256 dual speed automatic record changer for the regular 78RPM records or the new 33⅓ micro-groove records. New pick-up with needles mounted in tandam for flip of the wrist change. Base size 14x14". This is the famous tilt-o-matic model. Weight 18 lbs. Net **$31.53**

Webster model 246 dual speed automatic changer is a fine changer at a lower price and also requires less space. Weight 15 lbs. Net **$28.36**

UNIVERSAL OUTPUTS, 75c

4 Watt Single Plate Universal to VC **.59c**

4 Watt P. P. Plate Universal to VC **.75c**

8 Watt P. P. Plate Universal to VC **.95c**

12 Watt P. P. Plate Universal to VC **$1.25**

100 Assorted ¼, ½, and 1 Watt Resistors. All insulated and coded. Low Ohm to 10 Meg. 100 for **$1.49.**

ICA UNIVERSAL AC-DC LINE CORD **$0.59**

8 Foot G. E. Plastic AC Cord..10 for **2.00**

6½ Foot G. E. Plastic AC Cords 10 for **1.50**

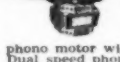
50 Mill AC-DC Chokes **.39**

Small Plastic Mike Cable, **4c** Per Ft.

Beldon Mike Cable, best quality, **6c** Per Ft.

BELDON 100 WATT IRON, $1.95

Radio Servicing, Standard 100 Watt Soldering Iron. $4.00 Value Net. **$1.95**



G.I. RM-4, $5.95

General Industries RM-4 heavy duty phono motor with T.T. 78 RPM. Scoop price **$5.95**

Deluxe quality 78 RPM phono motor with T.T. **$2.95**

Dual speed phono motor 33⅓ or 78. Reg. $11.00 list, scoop price **$4.95**

REPLACEMENT MOTOR, $1.29

Scoop-Replacement phono motor fits 90% of all changers. A scoop at only **$1.29 ea.**

WEBSTER "56," $19.95

Brand new Webster 56 Record Changers with Crystal Cartridge of Norman output voltage. These are new changers but have been removed from new radios to be replaced with dual speed models. A regular **$26.66 dealers'** net item offered for only **$19.95.**

Webster 56 Changer with Caltron V.R. Cartridge. (Use same preamp as G. E.) only 50 to sell at **$22.95.**

EYESTRAIN—A New Video Hazard

By W. S. STEWART
TV Ed., "International Photographer"

TV manufacturers must help eliminate this very real threat to television's entertainment role.

AMOUNTING number of television fans are finding that their favorite entertainment medium is causing them considerable grief in the form of eyestrain.

One factor contributing to this situation is the viewing of television screens in totally darkened rooms. This practice puts a severe strain on even normal eyes. Many optometrists recently have pointed out that alternate shifting of the eyes between a relatively bright television screen and an adjacent area of total darkness places an abnormal load upon the light accommodating mechanism of the eye.

One of the foremost reasons for dark room television viewing is the poor judgment used in cabinet design by many of the television manufacturers.

Too many TV cabinets employ highly reflective materials to mask the television screen.

Materials such as highly polished wood and brass, chrome and plastic trim and excessively large areas of polished plate glass surrounding the picture area provide sources of intense specular reflections from even subdued room lights or window light.

Some television cabinet designs are so poor that distracting specular reflections from the picture tube light itself are bounced into the observers' eyes from the picture area masking material. The latter situation is especially bad when the picture frame has an inside bevel.

Thus, the predominating tendency of television set owners to view their TV in total darkness is encouraged by the fallacies of picture-masking techniques on the part of the television manufacturers.

It may not be true, but the evidence seems to point to a professional, obstinate, and incongruous jealousy between the radio-television and motion picture industries.

The motion picture industry and allied photographic and visual arts professions have spent upwards of fifty years in the study of picture viewing.

The gamut from pure scientific research to empirically derived formulas, painstakingly developed over an extended period, has determined physiological and psychological medians and standards of practice which are difficult to refute with respect to picture viewing.

These decades of study have indicated that a dark, matte surface surrounding pictures of the transmitted-light type provides the optimum viewing condition.

It is difficult to comprehend upon what premise the TV manufacturers, relatively inexperienced in the visual aspects of communication, proceed to decorate picture-area borders with shining gingerbread of brass, chrome, and glittering plastic.

Some specular reflection is unavoidable due to the smooth glass surfaces of the cathode-ray tube face and the shatter-proof protective glass plate covering the picture area.

Thus, since the necessary materials involved in the actual presentation of the picture to the viewer are inherently reflective it seems to be extremely poor practice to aggravate the dilemma by masking the picture area with additional highly reflective materials.

In view of the fact that many of the spurious reflections from ambient light sources can be eliminated by obvious cabinet design treatments, it seems that some effort should be made in the direction of excluding the built-in reflections from the polished surfaces of the cathode-ray tube face and its protective glass plate.

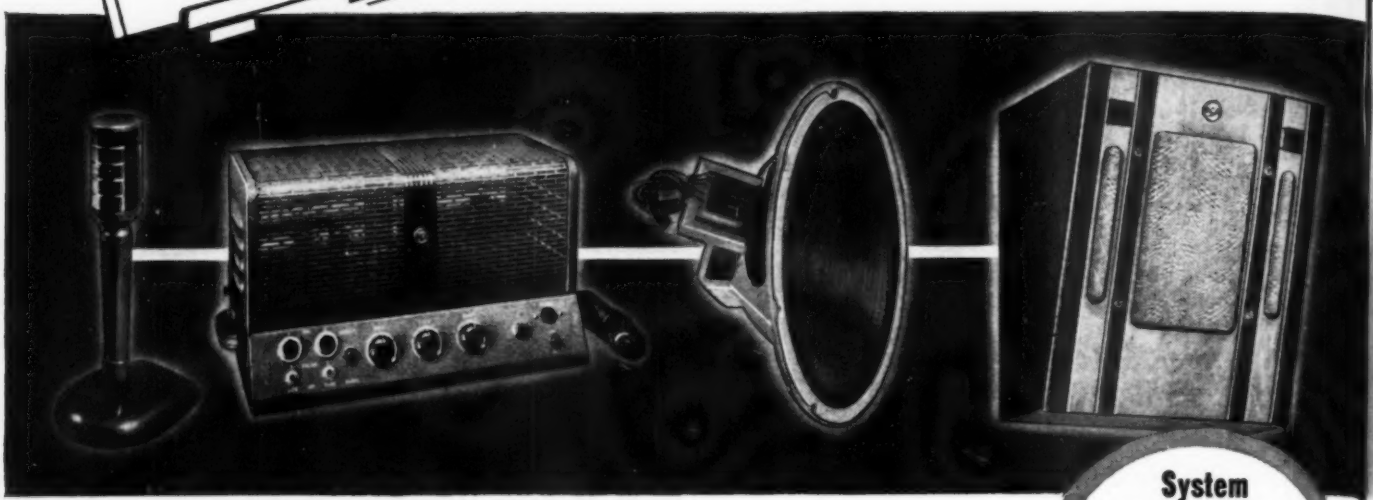
A variation on one of the coated-lens techniques, as applied to plane glass surfaces, might lead to a solution of the problem. Another solution might be found in some type of very light etching of the glass surfaces involved to reduce the unwanted reflections without intolerable loss of contrast range and definition.

Many suitable materials, from both a decorative and utilitarian standpoint, could be given matte finishes to offer practically non-reflective surfaces for masking the picture area of the television receiver.

The gain in consumer viewing comfort would constitute a definite contribution to the television art and at the same time eliminate a point of sales resistance which may eventually assume major proportions. —30—

Look at these SENSATIONAL LOW PRICES

Complete *MATCHED* High



RCA 25-WATT SYSTEM, UNEXCELLED VALUE

This complete, ready-to-operate, matched sound system surpasses any sound system you could buy at this sensational low price.

AMPLIFIER: High gain, wide range, low-distortion, 25-watt amplifier with inverse feedback. 2 high impedance microphone inputs—high and low impedance phono inputs—speech music switch and tone control—complete with tubes.

MICROPHONE: De luxe dynamic high impedance microphone—modern, rugged, lightweight, with 15-ft. cable and matching base.

SPEAKER: 12-inch PM speaker with 6.8 ounce Alnico V magnet and multi-tap line matching transformer.

BAFFLE: Attractively styled, sloping front, walnut finish, wood baffle.

EXTRA SPEAKERS AND BAFFLES: Available at comparably low prices.

System P-525-12W

$99.50*

Suggested list price.

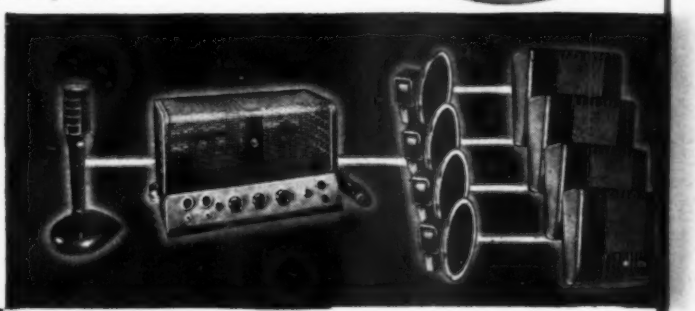
RCA HIGH QUALITY COMPLETE SOUND SYSTEM WITH 4 SPEAKERS

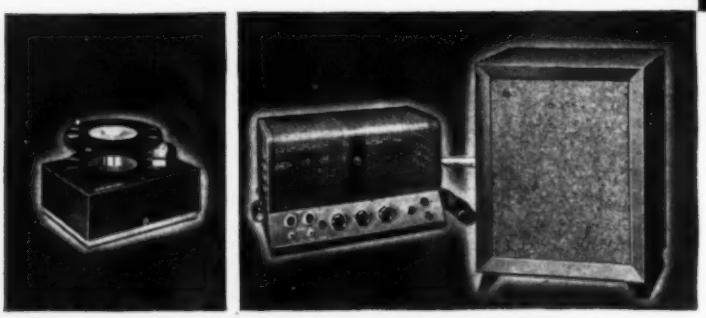
An ideal sound system for general applications—uses same 25-watt amplifier and microphone described in system P-525-12W—with 4 high efficiency 6-inch PM speakers with multi-tap line matching transformers and beautiful molded fibre, sloping front baffles. Compare this unparalleled equipment value.

System P-525—6F4

$119.50*

Suggested list price.





RCA DE LUXE MUSIC REPRODUCING SYSTEM

This system using the 25-watt amplifier described in System P-525—12W and a handsome modern console reproducer may be used with the sensational new *RCA 45 rpm Record Player*—or other turntable—or FM tuner to provide a superb music reproducing system. *Console Cabinet* is 22" wide, 25" high, 12" deep available in blonde or walnut finish. The new RCA 45 rpm record player (pictured above) using the new 7-inch distortion free records is ideal for use with any of these sound systems.

System P25—10C

$139.50*

Suggested list price. Less Record Player

All prices shown are suggested list prices subject to normal dealer discounts

***Prices do not apply outside the continental U.S.A.**

Ask Your nearest RCA SOUND PRODUCTS DISTRIBUTOR for FREE Catalog

84 pages of sound products—microphones, amplifiers, speakers, recorders, portable P.A. and other profitable items.

Quality Sound Systems by RCA...

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C. O. Davey Company
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Foster-Barker Company
408 W. 4th Street, Santa Ana
Otto K. Olesen Company
1534 Cahuenga Blvd., Hollywood 28
San Diego Theatre Supply
1030 Twentieth Street, San Diego

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McCormick Radio & Sound
614 Road Avenue, Grand Junction
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Radio & Appliance Distributors, Inc.
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Poague Radio & Sound Company
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2336 Liberty Street, Jacksonville

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RCA Victor Distributing Corp.
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Morris Distributing Co.
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Southern Radio Corp.
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Gustav-Hirsch Organization
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1312 Jackson Avenue, Toledo 2
Midwest Sound Equipment Division
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Write: Hamburg Brothers
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Atomic Sound Engineering Co.
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Ridley's, Inc.
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Raymond Rosen Engineering Products, Inc.
32nd and Walnut Streets, Philadelphia
Harrisburg, Pennsylvania
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Engineering Products, Inc.
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SOUTH CAROLINA

Radio Laboratories
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Warren Radio Supply
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Hahn Electronics Supply Corp.
350 E. Scott Street, Knoxville
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1071 Union Avenue, Memphis 3
Radio & Appliance Corp.
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TEXAS

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Midland Specialty Co.
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R. & R. Supply Co.
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If you are interested in qualifying as a distributor or dealer, please write to RCA Victor Division, Sound Products Group, Camden, N. J.

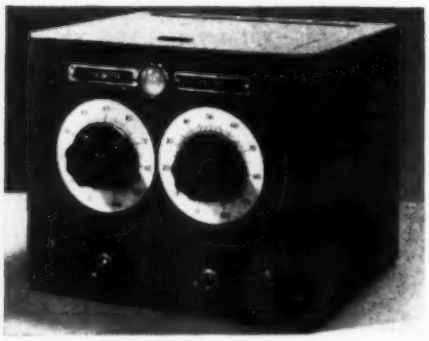
SOUND PRODUCTS
RADIO CORPORATION of AMERICA
ENGINEERING PRODUCTS DEPARTMENT. CAMDEN. N.J.

In Canada: RCA VICTOR Company Limited, Montreal

What's New in Radio

AUTOMATIC RESONATOR

Lewis E. Babcock & Co., 62 Basswood Ave., Providence 8, Rhode Island, has announced a small, inexpensive automatic resonating device, designed



to tune to resonance in succession, any desired number of grid and plate tank circuits. The unit will resonate the antenna tuning circuit, the final plate tank, and all the tuned circuits back to the first exciter stage plate tank in any transmitter.

The device can be incorporated in a transmitter by merely adding the motors, and running the connections from it to the resonator unit. The system is non-critical as to operating frequency and uses no special tuned circuits of its own, no selsyns, and imposes no limitations on the efficiency of the equipment with which it is employed.

Further information can be obtained by writing *Lewis E. Babcock & Co.*, at the Rhode Island address.

INSULATED CHOKES

Especially engineered for television and FM receiver requirements, the new line of fully insulated chokes announced by *International Resistance Company* are said to be relatively inexpensive. The firm believes the additional savings over so-called more conventional types are made possible because of the molded phenolic housing, which not only provides complete protection against high humidity, but

reduces assembly loss by affording protection from abrasion and physical damage.

These new chokes come in two sizes, Types CLA and CL-1. There is a wide range of size and characteristic combinations available. Resistance is low enough to enable their use as filament chokes for moderately high-power tubes.

Samples for testing as well as comprehensive catalogue data may be obtained by writing *International Resistance Company*, 491 N. Broad Street, Philadelphia 8, Penn.

ASTATIC CRYSTAL CARTRIDGE

The LQD crystal cartridge produced by the *Astatic Corporation*, Conneaut, Ohio, uses two separate, independent needles, one with one-mil tip radius to play the new long-playing records, the other with three-mil tip radius for standard recordings.

These double-needle, turnover type pickup cartridges use the Astatic "Q" and "Q-33" needles available for some time. A gentle pry with a penknife or small screwdriver lifts either of these special needles from its snap-in position in the cartridge, without removing the cartridge from the tone arm. Gentle pressure with the tip of a knife blade clicks the new needle into place. Removing or replacing one needle does not disturb the other.

Top reproduction quality also is claimed for the LQD, with excellent frequency response, particularly at low frequencies. A relatively high

vertical and lateral compliance of the Q needle design is said to provide appreciable reduction in needle talk.

The LQD cartridge has a stamped aluminum housing. The output voltages are 1.2 at 1000 cycles with 78 r.p.m. audio-tone test record; .75 with 33⅓ r.p.m. Columbia 281 test record; and .5 with 33⅓ r.p.m. Columbia 103 test record. Recommended needle pressures are 15 grams for 78 r.p.m. and six to eight grams 33⅓ r.p.m.

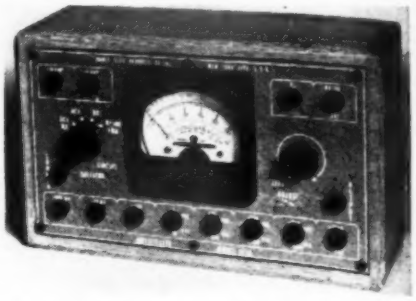
Write to *Astatic Corporation*, at Conneaut, Ohio, for more complete information.

STREAMLINED MULTITESTER

A new, streamlined version of the Model 447 manufactured by *Radio City Products Co.*, 152 W. 25th St., New York, N. Y., has been announced, with no increase in price scheduled for the improved unit.

This Model 447A Multitester is lighter in weight because of a magnesium panel and a new battery arrangement. The panel is attractively finished in hammertone grey with white markings to correspond to the other instruments in the line. The ohmmeter circuit has been simplified so as to have the same over-all coverage with only one unit cell and an improved battery holder.

Provision is made for extending the ohmmeter range to 10 megohms by using an external battery, and a gold-plated copper oxide rectifier with ex-



cellent current density characteristics gives improved performance for the measurement of a.c. and output voltages.

NEW MINIATURE CABINET LINE

Recent additions to the regular line of *Bud* sheet metal products include cabinets, boxes, amplifier foundations, and aluminum chassis for equipment using miniature tubes.

Bud Radio, Inc., now offers over 200 different sheet metal housings fabricated from steel and aluminum for radio and electronic equipment. Most of these are available for immediate delivery.

Estimates and manufacturing details are furnished upon receipt of engineering drawings. For complete information write to *Bud Radio, Inc.*, 2118 East 55th Street, Cleveland, Ohio.

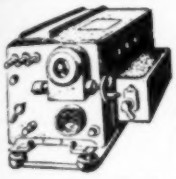
"THE MEGALIGNER"

A marking device which covers the frequency range of 19 to 49 mc., including all present and proposed i.f. bands, has been introduced by the *Kay Electric Company*, Pine Brook, N. J.

This new instrument, designated "The Megaligner," has a self-con-

tained power supply and provides a tunable c.w. signal which may be used as a signal source or with "The Mega-

GREAT BUY!



RU-16 receiver with 3 plug-in coil drawers. Great for hi-fi tuner, monitoring, etc. 3 stages TRF, BFO. Used. Price with tubes, plug and simple conv. diag. **$5.95 ea.** Brand new receiver with 5 plug-in coil drawers, shock mt. base, plug and conv. diag. **$16.95.**

RU-16-17 Receiver Control Box with plug. NEW. **$2.50 ea.**
Power Supply Kit for above Receiver. All parts and diag. included. **$9.45.**
RU-16-17 Tube Kit. 2—77's, 3—78's, 1—1642 tubes. ORIG. CARTONS. ONLY **$2.85 ea.**

LIMITED QUANTITY ITEMS

BC-342 Receiver. Used, but in good cond. Tested before shipping. **$79.50 ea.**

ARN-5A 11 tube Glide Path Superhet. NEW. 332 to 335 mc. Complete with tubes. Sealed cartons. Tubes alone worth the price of only **$10.95 ea.**

Telescopic Whip Antennas. BRAND NEW. Extends to 7' in nine sections. Complete with mtg. base. Sealed Cartons. Price **$1.75 ea.**

Push Button Tuning Unit. A Mechanical tuning mechanism which is adaptable to any tuner. 10 Chrome Plated Push Buttons operate tuning condenser. A Real Buy at **$1.95 ea.**

Desk type Telephone Mike. Mfgd. by Strom, Carlson and Kellogg. With p. to t. sw. ONLY **$2.95.**

COMBINATION OFFER. This month only. 70 ma. Power Xfmr., 70 ma. Choke, Dual 8mfd. 450v. Filter, 5Y3GT tube and socket. 275v. @ 70ma., 6.3v. @ 3a. output. All items NEW. Only **$4.95** for lot.

SCOOP! Here's a BUY. 10" P.M. Speaker with good sized Alnico 5 magnet. Large 1" voice coil. Sturdy construction throughout. Handles 10 watts. Reg. Price **$11.50.** Your cost **$4.60 ea.**

WHIP ANTENNA. 4 Sect. Chromed brass. Extends to 23¾". For UHF Ant., Beams, etc. 8-32 mtg. ONLY **90c ea.**

CONDENSER TESTER

• One of our best sellers! Useful, versatile laboratory item, in kit form. Simple, and easy to build in less than an hour. Checks condenser leakage and continuity up to 8-megs. Will test any paper, electrolytic, mica or oil condenser from 50-uuf. to 50-mfd. Self-contained power supply and neon bulb indicator with socket and bezel. Drilled Metal Cabinet. Complete instructions and diagrams included with each kit. **ONLY $4.85.**

REAL BARGAIN!

HS-16 Headphones with standard long cord (6 ft.) and adjustable headband. Unquestionably the best buy in surplus phones ever sold. Tested before shipping. Limited quantity. **$1.35 ea.** POSTPAID in U.S.A. and Canada.

POWER SUPPLY FOR ANY 274-N RECEIVER

Here it is—at last! Just plug it into the rear of your 274-N RECEIVER . . . any model! Complete kit, and black metal case, with ALL parts and diagrams. Simple and easy to build in a jiffy. Delivers 24 volts plus B voltage. No wiring changes to be made. Designed especially for the 274-N receiver. **All necessary parts for conversion of rest of receiver also included. ONLY $7.95. TUNING KNOB** for 274-N Receiver, **59c ea.**

SIGMA HERMETICALLY SEALED 7000 OHM SPDT RELAYS!

Operates on 1 ma. current change. This relay requires no maintenance as all moving parts and contacts are in a VACUUM! Contact ratings, 1 amp. Used in photoelectric equipment, remote control, receivers, etc. Heavy wire lead connections. Spade bolt mtg. Govt. cost many times our low price of only **$1.95** ea. 10 for **$17.00.**

KURMAN #1901 SPDT SENSITIVE RELAY

1700 ohm fast acting coil closes on 2 ma. 2 amp. 5/32" silv. cont. Mtd. on thick Mycalex base 2⅜" x ⅜". **BRAND NEW. $1.50** ea. or 10 for **$12.50.**

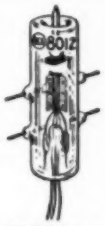
BC-221 Frequency Meter. Range 125KC to 20,000 KC. We have been fortunate to purchase another small lot of BC-221 Frequency Meters. In keeping with our policy of good merchandise, these units are all in excellent operating condition and each unit is checked before shipment. Perfect condition inside. Only minor scratches on outside of cases prohibit us from calling these units brand new. Get yours NOW as we know these will not last long! Complete with tubes, original calibration chart and crystal **$59.95 ea.**

BC-221 Power Supply Kit. Includes chassis, transformer, rectifier, all parts and diagram **$5.85 ea.**

BC-221 Modulation Kit. Converts any BC-221 for modulation. All parts and diagram included. ONLY **$2.50**

BC-221 Set Spare Tubes. ONLY **$1.29.**

VHF SURPLUS TUBES



FILAMENTS TESTED BEFORE SHIPMENT! ALL BRAND NEW!

RCA 8012 VHF Triode. TANTALUM plate and Tantalum grid! 35 watts output. 40 watts Plate Dissipation. Used as osc. or amp. at full ratings up to 500 MEG! C.T. 6.3v. Filament reduces filament lead inductance. All Brand NEW! Reg. price, **$14.50.** A large quantity purchase allows us to reduce the price of this tube to only **$1.50** ea. or 4 for **$5.00.**

826 UHF Triode. Full ratings (86 watts output) up to 250 mc! Get real power on 2 meters with a pair of these tubes. BRAND NEW! Get yours NOW **75c** ea. or 4 for **$2.40.**

WE717A PENTODE. Hams know this tube's ability to "soup up" any receiver. Has transconductance of 4,000 and is interchangeable with 6SK7. Low loss base and ultra-short leads. Functions better at high frequencies. ALL BRAND NEW! Orig. cost **$3.75** ea. Your price **98c** ea. or 4 for **$3.25.**

829 Twin Beam Tetrode. Ideal for UHF. Brand new in orig. cartons. **$2.80** ea. or 4 for **$10.80.**

829B Twin Beam Tetrode. This well known tube is ideal for application at VHF. Full output (87 watts) up to 200 MEG! BRAND NEW! **$3.95** ea. or 4 for **$13.50.**

832 Twin Beam Tetrode. NEW. **$2.50** ea. or 4 for **$8.80.**

832A Twin Beam Tetrode. 26 watts output up to 200 MEG! BRAND NEW! ONLY **$3.95 ea.**

807 Beam Tetrode. One of the most popular tubes for r.f. application. Brand new, **$1.12** ea. or 4 for **$3.95.**

810 Power Triode. This tube is a real powerhouse! 575 watts output up to 30 mc! Carbon anode. Grid outside of envelope for max. h.f. efficiency. BRAND NEW! Only **$5.95** ea. or 4 for **$21.95.**

815 Twin Beam Tetrode. Full ratings (56 watts output) up to 125 mc! Requires only .18 watt grid driving power for full output. Brand new. Only **$2.50** ea. or 4 for **$9.20.**

836 H.V. Rectifier tube. Similar characteristics to 866. Interchangeable. Don't miss this BUY! 2 for **$1.10.**

872 Rectifiers. New. **$1.75** ea. or 2 for **$3.25.**

5U4G and 5Z3 tubes. New . . . . . 39c ea.

6AB7, 6AC7 tubes. New . . . . . 79c ea.

6L6G Nat'l Adv. Brand. NEW. Don't miss these at **79c** ea. or 4 for **$3.00.**

CK-1005 Rectifier. Cut off pin # 6 and you have an OZ4. Several different experimental circuits inc. with each order. Price **3 for $1.00** Postpaid.

NEED 866 TUBES?

Then you'll be interested in our large shipment of NEW 836 tubes, just received. Same base connections and very similar ratings to 866. Hi-vacuum eliminate hash trouble. Navy used them extensively in various equip. because of this reason. Internal voltage drop similar to 866. Characteristics: Fil. 2.5v. @ 5a. Plate curr. 500ma. (av.) for 2 tubes. Inv. Peak v. per tube, 5,000v. OUR PRICE IS THE SCOOP OF THE YEAR! 2 for **$1.10.** Be sure to get yours while quantity lasts.

5-VOLT, 60-AMP. XFMR.

110v. 60 cyc. pri. Ideal for 304TL, VT-127A, etc. NEW. Mfgd. by Kenyon. Limited quan. **$5.95.**

2½-VOLT, 10-AMP. XFMR

110v. 60 cyc. pri. 13,000 v. ins. For 836 and 866 rectifiers. NEW. Mfgd. by Kenyon. BUY. **$4.95 ea.**

COLLINS MODULATION XFMR

Handles 2,000 watts audio power. BRAND NEW. Pri. imped. 12,000 ohms. Sec. 4,000 ohms. Freq. resp. ± 1 db. to 5,000 c.p.s. Sec. carries dc of mod. amp. 10½x13½x11½". Wt. 166 lbs. boxed. Orig. boxes. **$59.50 ea.**

COAX FITTINGS

UG/21U Straight plug. **25c ea.**
CQA 49470 Chassis recept. for UG/21U. **25c ea.**
UG/29U Straight Union. Fits UG/21U. **15c ea.**
UG/27U Rt. angle adaptor plug. **30c ea.**
British type snap-on coax. plug and socket combination 10H/701 plug and 10H/528 recept. Set **25c ea.**
83-1 SPN/PL-259A Stnd. Coax. Cable plug. **49c ea.**
83-1R/SO-239 Chassis recept. for above **79c ea.**

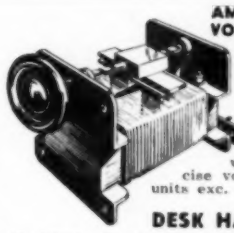
RM-53 REMOTE CONTROL BOX

Two way telephone conversation can be routed over a transmitter and receiver output transferred to a telephone line with this handy remote control box. ONLY **$2.50 ea.**

R-1/ARR-1 Homing Receiver

Read excellent article in Jan. RADIO NEWS how to convert this receiver to high freq. converter to use with your present receiver. Beautifully built, compact, easy to convert. Like new cond. with 4 acorn tubes and plug. ONLY **$9.95 ea.**

AMERTRAN TRANSTAT VOLTAGE REGULATOR



Here's a real value! **Spiral screw** type brush adjustment with handwheel. Extremely heavy brushes. 2.17 max. amps. Voltage range 103-126 volts. 115v. 60 cycle fixed winding. Useful for precise voltage adjustments. All units exc. cond. ONLY **$4.95 ea.**

DESK HANDSET HANGER

Designed to fit all type handsets equipped with butterfly switch such as TS-9, 11, 13, etc. Circuit opening switch operates when handset is returned into place. Switch contact ratings 5a. 110v. Handsomely finished in Black Crackle. ONLY **$5.95 ea.** Limited Quan.

HANDSET HANGER

Accommodates all makes and models (W. E. Kellogg, American, etc.) handsets such as TS-9, 11, 13, etc. Fastens to side of desk or on telephone or radio equipment. Felt facing protects handset. Black crackle finish only. **$1.95 ea.**

TS-10 SOUND POWERED HANDSETS

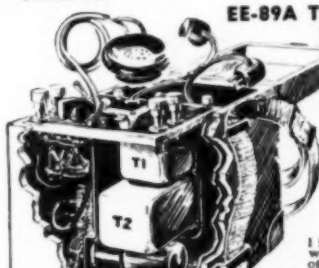
These are what you have been waiting for! All BRAND NEW. Made by WE, RCA and Automatic Elect. Requires no batteries or transformers, of course! Useful for TV antenna installations, inter-comms, line communication, etc. "No battery" feature makes it possible to provide communications in plants where explosive chemicals are used. Clip a TS-10 on each end of a line and you have communication in a jiffy. Air-mail or wire your orders now as quantity is limited. Price **$16.95** per pair. **Replacement WE Receiver Units for ONLY $4.95 ea.**

TS-10 Handsets

RM-29A TELEPHONE

These famous telephones now available in limited quantity. Contains magneto ringer system for calling. Uses standard batteries available anywhere. Only two wire line needed to connect. Units may be paralleled on same line. Lines up to several miles can be used. Ideal for Communication, Orientation of TV Antennas, Farms, Factories, etc. One RM-29A Telephone with battery and one TS-13 Handset, all BRAND NEW. PRICE **$12.95 ea.**

EE-89A TELEPHONE REPEATER



Here's a REAL BUY. Improves transmission and extends talking range of EE-8 and RM29-A telephones. Only 2 wire lines used. Simplex telegraph and 20 cycle ringing possible over lines equipped with one or more of these repeaters. Hybrid coil allows transmission in both directions. Supplied with low-drain 3Q5 tube. Batteries used: 1½v. and 90v. Featherweight phone supplied. simplifies gain setting. BRAND NEW. Complete with instruction manual, ONLY **$9.95 ea.** Limited quantity.

Brand new ELECTRIC PAINT SPRAYER

Just plug it into any 110v. AC outlet and spray! No compressor or other bulky equipment needed. This improved model has moulded bakelite head with trigger-control and nozzle adj. Sprays lacquer, enamel, varnish, disinfectants, insecticides, light oils, etc. Perfect for all radio and household uses. Ordinary Mason Jars can be used. Burgess Vibro-sprayer with instructions, extra orifices and jar, ONLY **$12.95** POSTPAID in U.S.A. and Canada.

★ 4-HOUR MAIL-ORDER SERVICE. WE SHIP ANYWHERE.
20% DEPOSIT MUST ACCOMPANY ALL ORDERS, BALANCE C.O.D.

OFFENBACH & REIMUS CO.

072 ELLIS ST. SAN FRANCISCO, CALIF. 'PHONE—ORdway 3-8551

Sweep" to produce a tunable "birdie" type marker on an oscilloscope display. In addition, when used with "The Mega-Sweep," a tunable "pip" type marker may be connected directly to the vertical amplifier of the display oscilloscope, if desired, which does not overload the receiver or disappear in traps.

The two markers have independent amplitude controls, and the accuracy of the instrument is 5 per-cent of full scale. "The Megaligner" is priced at $150.00, F.O.B. Factory.

MOBILE DX CONVERTER

The *Gonset Company* recently announced that it has in production a compact short-wave converter to permit reception on an ordinary auto radio.

The converter derives power from the set and uses the regular auto

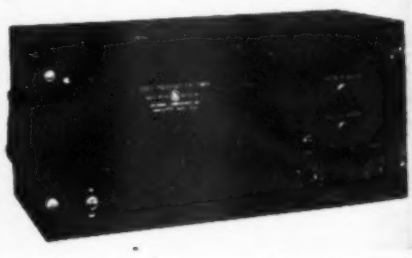
antenna; normal or short-wave reception can be obtained if desired. By means of a bandswitch, it covers all frequencies between 3 and 30 megacycles, and short-wave signals can be brought in from all over the world with good volume. The work of connecting the converter is simple and takes but a few minutes.

Further details on this Model 3-30 may be obtained by writing to the *Gonset Company,* 72 E. Tujunga Ave., Burbank, Calif.

FIXED-FREQUENCY TUNERS

Of the three fixed-frequency FM tuners recently announced by *Browning Laboratories, Inc.,* Winchester, Mass., Model RP-25 combines most of the features of the others and, besides, permits turning the audio "on" or "off" as required.

In common with the *Browning* Model RP-23, it is crystal controlled and



adapted to relay reception, storecasting installations, or monitoring purposes. As in the Model RP-24, it also contains relay circuits that operate on tones of from 15 to 20 kilocycles received from the transmitter and which select in sequence two preset audio volume levels that may be man-

has a new meaning now!

Stylus Replacement Often

WHEN the big attraction hit town they hung the "Standing Room Only" sign—it meant overflow business.

It still means that, but the big attraction now drawing overflow business for distributors and dealers is the G-E Variable Reluctance Cartridge with the Replaceable Stylus.

Why? Because record fans who know their records best wanted the finest reproduction possible. The G-E Variable Reluctance Cartridge gave them just that. To secure peak performance they often replaced the cartridge when the stylus was only slightly worn.

Now, with the Replaceable Stylus, cartridge replacement is no longer necessary. In four easy steps the cartridge can be removed from the tone arm, the stylus changed and listening pleasure increased.

Economy is the big feature but this redesigned cartridge has many other advantages. Smaller in size, it can be adapted to many more tone arms. Higher lateral compliance provides more faithful tracking, hence better fidelity. Frequent stylus replacement reduces record wear and adds hours of top listening pleasure. Needle talk and needle scratch are negligible, giving cleaner, finer reproduction.

Best of all, the cartridge is available for either the new LP records with 1 mil stylus or for conventional records with the 3 mil stylus.

The counter sized dispensing unit for greater sales—7⅜" long, 5½" wide, 4¾" high at the back.

Now for the *Big Extra* to step up sales! A neat dispensing unit for the counter with two cartridges and six stylii recessed in a gold-flocked panel to catch the eye. The entire unit is finished in an attractive blue and has a compartment in the rear for additional stock. It is a silent salesman that keeps selling. See your distributor right away for details.

For complete information on Variable Reluctance Cartridges and Replaceable Stylii write to: *General Electric Company, Electronics Park, Syracuse, New York.*

You can put your confidence in—

GENERAL ELECTRIC

ually adjusted from zero to full output.

Model RP-25's two relay operations are controlled by transmitted tones of different frequency and are, therefore, independent. As in the RP-24, the relay circuits are preset to operate at 15, 17½, or 20 kilocycles, as specified by the customer.

All of the models are rack panel style, finished in black leatherette, and can be supplied with steel cabinet if desired.

For further information, address the company at 742-750 Main Street, Winchester, Mass.

NEW TELEVISION CAPACITORS

Distributors of the *Sprague Products Company*, North Adams, Mass., have been supplied with complete lines of the company's television replacement electrolytic capacitors, engineered especially for the tougher applications.

These new type TVA and TVL "Twistlock" electrolytics are designed to stand up under the extremely high temperatures, high ripple currents, and high surge voltages encountered in television receivers.

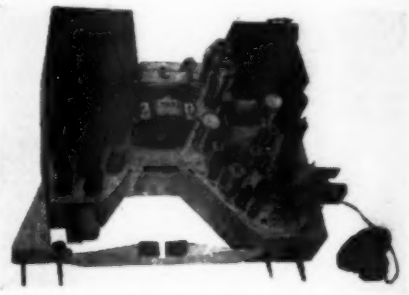
Complete descriptions of these capacitors is given in the *Sprague* bulletin M-429, available upon a postcard request, and the listing includes 93 separate ratings comprising the units most needed by teleservicemen. Address inquiries to *Sprague Products Company*, North Adams, Mass.

PRE-ALIGNED KIT

Believing that pre-alignment of the vital channels is the only satisfactory method of kit assembly, the *Philmore Manufacturing Company, Inc.*, has designed its TV kit with tuner, video, and sound channels completely wired and fully aligned.

Among the features *Philmore* has provided are complete 12-channel tuning, daylight viewing, built-in extra power for video up to 16 inches, PM speaker with choke, and the mounting of all components to the chassis. A licensee of *RCA*, the company reports also that the kit circuit is very similar to the well-known *RCA* 630TS and 830TS.

Also available are the *Philmore* custombuilt television receivers, supplied



without cabinets, completely wired and assembled ready to play. These can be installed in any piece of furniture, and the customer has a choice of any picture size from 10 to 16 inches.

For further details, write the *Philmore Manufacturing Company, Inc.*, 113 University Place, New York 3, N. Y.

DIRECT-VIEW TV KITS

From now on, the direct-view television receivers made by the *Television Assembly Co.*, 540 Bushwick Ave., Brooklyn, N. Y., will be delivered with all of the major components mounted.

These changes were announced the first part of April by the *Snaider Television Corporation*, which operates *Television Assembly Co.*, as well as *Television Industries Co.*, as subsidiaries.

This innovation by *Television Assembly Co.*, which makes television kits for direct-view tubes from 10" up

SAVE and Be SAFE!

Buy Surplus & Standard Equipment with money-back guarantee at

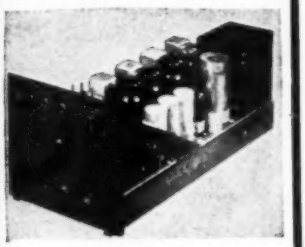
R & M RADIO

EXTRA TUNING UNITS

$2.50 each, FOB, Kingman, Ariz., or Arlington, Va.

Types in stock: TU 5-7-8-9-10-26.

Typical components: 2 vernier dials; 1 var. cap., 20-135 mmf.; 1 var. cap., 20-156 mmf.; 1 var. cap., 8-26 mmf.—neutralizing; 1 .00003-2000V cap., CD—Mica; 3 .00009-3000V cap., CD—Mica; 2 .0004-500V cap., CD—mica; 3 .0001-3000V cap., CD—Mica; 2 4-position ceramic band switches; 2 RF chokes; 1 tank coil—ceramic form with tapped ant. coupling coil; 1 tank coil—ceramic form; 1 parasitic suppresser; 2 ceramic flex. couplings; plus banana jacks, stand-off insulators.



APN-4 RCVR—'SCOPE POWER SUPPLY

4 switch-selected screw-driver tuned RF channels; IF freq. 1050 kc, band-width 45-60 kc; RF freq. 16 2000 kc. Tubes: (2) 2Y2, (3) 6B4, (4) 6SK7, (1) ea. 5U4, 6SU7, 6SA7, 6H6, VR150. Makes fixed tuner for med. freq. police calls or PA system. Has power supply for 5" scope, with 400 cycle trans. Electronic-controlled low v. supply; delivers 260 vdc. 150 mils reg. to .01%. Power supply alone worth more than price..... **$8.95**

Buy it for conversion! Buy it to cannibalize!

Buy it to get on the air! It's the war-proved, versatile

Complete with

- **tuning unit (TU-6)**
- **antenna loading unit**
- **dynamotor**
- **set of plugs**
- **all tubes**
- **wiring diagram and conversion data free**

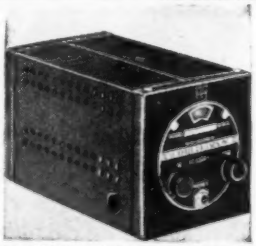
BC-375-E

Quantity Limited

19.95

FOB KINGMAN, ARIZ.

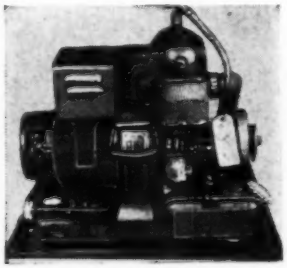
Complete conversion diagram included. Xmtr. designed to operate from 200 kc to 12 mc (less BC band). Equipped with antenna tuning unit BC-306-A—variometer and tap switch. Dynamotor (PE-73-C) complete with relay, fuses and filter.



BC 1206, LAZY Q FIVER

SINGLE SIGNAL RECEPTION **$9.95**

The littlest BIG BUY ever offered! A BC-1206 Setchell Carlson receiver will take the place of BC-453 (Lazy Q Fiver). We think it's even better. Here's why: **Smaller** — 4" x 4" x 6⅝"; weighs only 3 lb. 14 oz. **Less' current drain**, .75 amps at 24 v. DC. IF freq. 135 kc. A conventional superhet circuit is employed and is arranged so that AVC will prevent overloading on strong signals.



The Famous PUTT-PUTT

Gasoline Generator (HRU-28)

28 - 32 Volts D.C. ONLY **$74.50**

Single cylinder, 2-cycle gasoline engine with generator that is rated at 2,000 watts direct current, 70 amps. Has unlimited use around a farm; useful as field day power supply. More literature upon request.

DUAL POWER SUPPLY

SAVE YOUR BATTERY

Both for $8.95

$4.95 each

Use our dual dynamotors by wiring them in series and use one on receivers and both in transmitter. High voltage output 600 volts at 48 watts. Low voltage 300 volts at 24 watts.

INTER-COM

Factory Close-Out!

Brand New and Priced for Quick Clearance!

Limited Quantity **$14.95**

(List price $34.95)

Price includes master station, one remote, and 50' of wire. Rig it up as a "baby-sitter" with pick-up at baby's crib. Useful in office, or for instant contact with basement, garage, attic, kitchen. Simple to install—just plug it in to 110 v. AC or DC socket.

TRANSFORMERS

For converting SCR-274-N to 115 Volts AC.

No. 1 Power Transformer. Pri—115v 60 cycle; sec—500 CT .06 Amp. 24v —½ amp.
Price only $3.90

No. 2 Filament Transformer. Pri—115v 60 cycle; Sec. 1—14v 7½ amp.; sec. 2 14v 7½ amp. Series 28v 7½ amp. Parallel 14v 15 amp.
Price only $4.50

No. 3 Filament XMFR. Pri—115v 60 cycle; Sec. 24v 2 amps.
Price only $2.25

• Speakers—Brand New

Permanent Magnet

4"	$ 1.60
5"	1.85
12" Jensen in Metal Case	14.50

10% discount, purchase of 2 or more

• Heavy Duty Transmitting Chokes

8 HY—500 MA—5000 V INS.
Price each $8.95

• Condensers—Fixed

.05	Mfd.	600 Volts	$0.15
10	Mfd.	350 Volts	.69
15	Mfd.	150 Volts	.60
16 x 16		450 Volts	1.20
20		250 Volts	.69
40		150 Volts	.75
50		150 Volts	.69
150		25 Volts	.54
200		10 Volts	.45
8 x 8	Can.	Electrolytic	1.50

Tubes (New, in Original Cartons).

For the SCR-274-N Command Set & Others.

12A6	69c	OD8- VF150	75c
12SR7	69c	12SA7	69c
12K8	69c	77	59c
12SK7	69c	78	59c
12SF7	69c	89	59c
1625	89c	38322	$1.19
1626	79c	12J5-GT	69c
1629	89c		

ALL EQUIPMENT F.O.B.

R & M RADIO COMPANY

2701 WILSON BLVD. DEPT. RN-59 ARLINGTON, VIRGINIA

• SAVE C.O.D. CHARGES and speed your order by remitting in full or 25% deposit. Please don't send money for postage, we ship "transportation charges collect." These prices supersede all previous prices. Write every month for BARGAIN BULLETIN.

to 20" as well as a projection television receiver with a 520" screen, will leave only 13 tubes to be wired. The change involves the pre-wired i.f. picture and sound strip, named the "Vivideo" feature, and the front ends.

NEW PHONOMOTOR UNITS

Many customers will find the new *Alliance* Dual-Speed 33⅓-45 r.p.m. phonomotor unit very economical for the new LP records.

This unit, together with a new single-play 45 r.p.m. record player, intended expressly for the newer records, will be made available in individual boxes to the radio-phonograph distributors. Although the Dual-Speed player assembly is primarily intended as a single player, the mechanism, consisting of motor and turntable, can also be adapted to changers.

The *Alliance Manufacturing Company*, Alliance, Ohio, started mass production of both models around March 1, and it expects a large volume of business from many consumers who will want to replace older-style players with the new assemblies.

MINIATURE LAMPS

Packaged in the familiar red, black, and white colors, a well-rounded line of miniature lamps has been announced by the *RCA* Tube Department, Camden, New Jersey.

These were planned to give the radio service dealer a wide assortment of lamps to take care of everyday replacement needs, and to fill practically every radio panel and flashlight need.

The line includes sixteen different types for radio panel and miscellaneous replacement use, and eight types for flashlight replacement purposes, and is available from *RCA* tube and parts distributors.

FIELD STRENGTH METER

The *Transvision* Model FSM-1 field strength meter which has been designed to facilitate television installations consists of a compact, high-gain receiver with a calibrated meter to indicate signal level. Each unit is individually calibrated. The instrument comes complete with self-contained power supply for operation at 120 volts, 60 cycles.

This compact, portable service instrument includes among other features a 13 channel selector. It measures actual picture signal strength besides losses or gain of various antenna and lead-in combinations. It is useful for checking receiver reradiation; amplitudes of interfering signals can also be checked.

For further information write to

Transvision, Inc., New Rochelle, New York.

ALL-RECORD PHONOGRAPH

Arthur Ansley Manufacturing Company of Doylestown, Pennsylvania, announces the production of a portable phonograph that will play all types of records, both 33⅓ and 45 r.p.m., as well as the standard 78 r.p.m. discs.

The unit is housed in a compact, luggage-type case 13½ by 16 by 7¼ inches. It features a turntable with two spindle diameters, one for the standard and *Columbia* long-playing records, and one for the new *RCA* types.

INDOOR ANTENNA

The TVI-43 indoor antenna made available by the *Ward Products Corporation* is said to bring in all stations in metropolitan multi-station areas, precisely and brilliantly.

It is an attractive item, blending with most interiors, with chrome plated brass telescopic dipoles, and satin beige finish. Engineered and weighted so that it will not tip over, it will extend to a full 7 feet 9 inches, but can be stored without difficulty.

Further information on the TVI-43 will be supplied by the company, a division of the *Gabriel Co.* Address *Ward Products Corporation*, 1523 East 45th St., Cleveland 3, Ohio.

—30—

NOW SAME WEEK DELIVERY! RADIO TUBES

34½¢ ea. in lots of 100 or more

YOUR CHOICE

LARGEST TUBE STOCK IN THE COUNTRY AT ROCK BOTTOM PRICES. Cartoned and Guaranteed . . . 39c ea. in smaller quantities.

34½¢ ea. in lots of 100 or more

FREE! Cornell-Dubilier, Mallory, Aerovox, Sprague, Solar, Filter Condensers—ten fast moving filters FREE with each 100 tubes.

Popular GT Miniature and Loctal Tubes. All individually cartoned and guaranteed best quality. Available at this low price and may be assorted. THE FIRST REAL SCOOP FOR THE SERVICE DEALER.

7Y4	5Y3GT	6K6GT	12A7	25L6GT	47
7Z4	5Y4G	6K7GT	12AT6	25Z5	50
7B6	5Z3	6P5GT	12AU6	25Z6GT	50B5
7E6	6A7	6Q7	12C8	26	50L6GT
7C4	6AC5GT	6Q6GT	12BA6	27	56
14X7	6A3	6R7	12BE6	30	57
1B4	6A8GT	6SA7GT	12F5	31	58
1C4	6AJ5	6SC7GT	12H6	32L7GT	70L7GT
1L4	6AQ6	6SD7GT	12J5GT	35	71A
1P5	6AT6	6SF5GT	12J7GT	35/51	75
1R5	6B6	6SF7	12K7GT	35B5	76
1S4	6B7	6SG7GT	12K8G	35C5	78
1S5	6BA6	6SH7	12Q7GT	35L6GT	81
1T4	6BE6	6SJ7GT	12SA7GT	35W4	83
1U4	6C4	6SK7GT	12SH7GT	35Z5GT	84/6Z4
1V	6C5GT	6SL7GT	12SG7	37	75
2A3	6C6	6SQ7GT	12SJ7GT	37A	112A
2A5	6C8G	6SR7GT	12SK7GT	38	89
2A7	6D6	6U7GT	12SN7GT	39	117Z3
2B7	6F5G	6V6GT	12SQ7GT	39/44	182B
3A4	6F6GT	6X4	12SR7	40	183
3Q4	6F8G	6X5GT	12SR7GT	41	482B
3S4	6G6	6Y6G	20	42	483
5U4G	6H6GT	10	2050	43	
5V4	6J5GT	12A8GT	2051	44	
5X4G	6J7GT	12A6	24A	46	

TELEVISION and FM TUBES

SPECIAL each **49c** in 100 lots assorted 54c ea. in smaller quantities.

1B3	6AL5	6S8GT	12AT7
2C34	6AQ5	6SN7GT	12AX7
2EZ4	6AU6	6SS7	12BA7
4A6G	6BD6	6T8	12S8
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1G4GT	1Q5GT	7Q7	117L7GT
1H5GT	2V3G	7H7	117P7GT
1J6G	3LF4	7J7	117Z6GT
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7c each — Lots of 100 (assorted) **$5.95**

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.01	ea. 7c
.02	ea. 7c
.05	ea. 8c
.1	ea. 9c

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20 mfd, 150V	ea. 25c	25 mfd, 25V	ea. 17c
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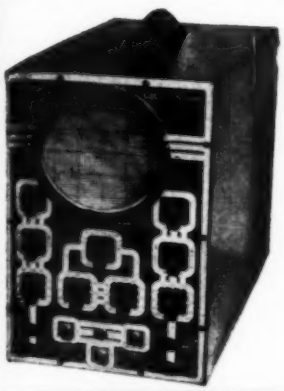

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THE NEW MODEL 670

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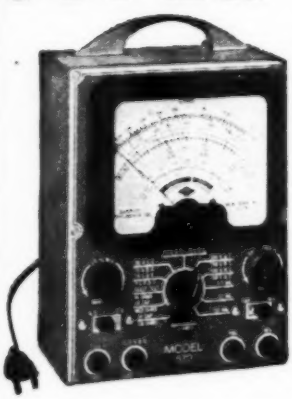

SUPER METER. A Combination VOLT-OHM-MILLIAMMETER plus CAPACITY REACTANCE, INDUCTANCE and DECIBEL MEASUREMENTS.

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INDUCTANCE: 1.75 to 70 Henries; 85 to 8,000 Henries.

DECIBELS: —10 to +15, +10 to +38, +30 to +58.

The model 670 comes housed in a rugged, crackle-finished steel cabinet complete with test leads and operating instructions. Size 5½" x 7½" x 3". **$28.40 NET**

The New Model 770—An Accurate Pocket-Size

VOLT-OHM MILLIAMMETER

(Sensitivity: 1000 ohms per volt)

Features:
Compact measures 3⅛" x 5⅜" x 2¼". Uses latest design 2% accurate 1 Mil. D'Arsonval type meter. Same zero adjustment holds for both resistance ranges. It is not necessary to readjust when switching from one resistance range to another. This is an important time-saving feature never before included in a V.O.M. in this price range. Housed in round-cornered, molded case. Beautiful black etched panel. Depressed letters filled with permanent white, insures long life even with constant use.

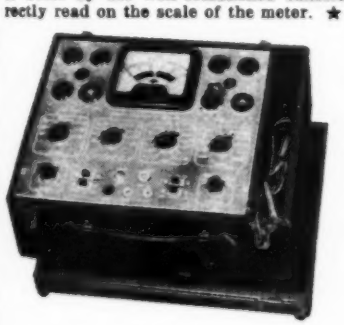
Specifications: 6 A.C. VOLTAGE RANGES: 0-15/30/150/300/15000/3000 volts.
6 D.C. VOLTAGE RANGES: 0-7½/15/75/150/750/1500 volts.
4 DC. CURRENT RANGES: 0-1½/15/150 Ma. 0-1½ Amps.
2 RESISTANCE RANGES: 0-300 ohms. 0-1 Megohm.
The Model 770 comes complete with self-contained batteries, test leads and all operating instructions. **$13.90 NET**

THE NEW MODEL 777

20,000 OHMS PER VOLT!!

TUBE & SET TESTER

Tube Tester Specifications:
★ Tests all tubes including New Miniatures, etc. Also Pilot Lights. ★ Tests by the well-established emission method for tube quality, directly read on the scale of the meter. ★ New type line voltage.



V.O.M. Specifications:
D.C. VOLTS: (at 20,000 Ohms Per Volt), 0 to 7.5/15/75/150/750/1,500 Volts.

A.C. VOLTS: (At 10,000 Ohms Per Volt), 0 to 15/30/150/300/1,500/3,000 Volts.

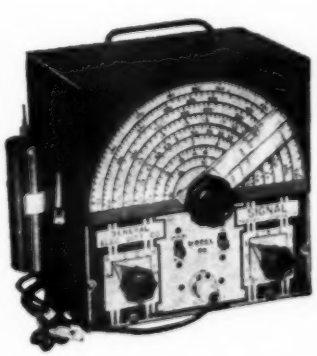
D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5 Amperes.

RESISTANCE: 0 to 5,000/50,000/500,000 Ohms, 0 to 50 Megohms.

Model 777 operates on 90-120 volts 60 cycles AC. Housed in beautiful hand-rubbed cabinet. Complete with test leads, tubes, charts and detailed operating instructions. Size 13" x 12½" x 6". **$59.95 NET**

The Model 88—A COMBINATION

SIGNAL GENERATOR AND SIGNAL TRACER



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*Frequency Range: 150 Kilocycles to 50 Megacycles. *The R.F. Signal Frequency is kept completely constant at all output levels. *Modulation is accomplished by Grid-blocking action which is equally effective for alignment of amplitude and frequency modulation as well as for television receivers. *R.F. obtainable separately or modulated by the Audio Frequency.

Signal Tracer Specifications:
*Uses the new Sylvania 1N34 Germanium crystal Diode which combined with a resistance-capacity network provides a frequency range of 300 cycles to 50 Megacycles.
The Model 88 comes complete with all test leads and operating instructions. ONLY..... **$28.85 NET**

20% DEPOSIT REQUIRED ON ALL C.O.D. ORDERS

GENERAL ELECTRONIC DISTRIBUTING CO. DEPT. RN-5, 98 PARK PLACE NEW YORK 7, N. Y.

Ghost Elimination

(*Continued from page* 72)

each potentiometer must be adjusted to some particular value to obtain a proper match. That is, one potentiometer cannot be changed to compensate for the incorrect adjustment of another potentiometer.

Unless the relative magnitudes of receiver and line impedances are known, it is quite possible that the potentiometer pad will be tried the "wrong way" on the first trial, and no match will be found. In this case, the pad should be reversed and a match sought with the new connections.

If it is found impossible to eliminate the ghost with the variable pad, a defective transmission line is indicated. For example, there may be a break or short in one side of the line. Such defects can usually be detected by a visual or ohmmeter check.

Balanced Input, Unbalanced Line

When it is desired to operate a receiver with balanced input circuit from an unbalanced line, the input circuit may be arranged as shown in Fig. 4A. As an example, a 300-ohm balanced input circuit is shown in combination with a 75-ohm unbalanced line. One half of the input circuit is shunted with a 150-ohm resistor load. This 150-ohm dummy load provides correct loading for the unenergized half of the input. The other half of the input circuit is energized from the line through a pad designed to match 75 ohms to 150 ohms. The values for both resistances in this pad (as found in Fig. 4A) are 100 ohms.

Unbalanced Input, Balanced Line

When it is desired to operate a receiver with an unbalanced input circuit from a balanced line, it is possible to use the arrangement shown in Fig. 4B. In this diagram, a 300-ohm balanced line is shown properly matched to a 75-ohm receiver. It will be observed that a 75-ohm dummy load is provided to maintain line balance to ground, thus preserving the antenna and line characteristics.

The receiver and dummy load together present a 150-ohm resistance to the 300-ohm line. Consequently, a pad which utilizes two 110-ohm resistors and one 220-ohm resistor is required to match the 300-ohm line to the input system. The pad indicated in Table 2 for matching a 300-ohm impedance to a 150-ohm impedance is comprised of two 220-ohm resistors. Because the line is balanced, however, the 220-ohm series resistance is split into two 110-ohm sections, with one section in each side of the line.

It should be noted that the noise-rejection feature claimed for a balanced line is lost in the circuit of Fig. 4B, because the receiver is energized from only one side of the line. Moreover, the matching losses are doubled when a dummy load is used. Thus, in the circuits given in Fig. 4A and Fig. 4B, the operating losses are about 12 db. This figure, however, is only about 6 db. more than the power loss encountered if a pad were not used. In strong-signal areas, satisfactory ghost-free reception can be obtained with these matching systems. In weak-signal areas, however, it may be necessary to forego these expedients and replace the transmission line with a line having characteristics which match the receiver.

It is interesting to compare the power loss due to mismatch with the power loss caused by the insertion of a matching pad. Such a comparison is given in Table 3. It can be seen from this tabulation that the power loss due to the addition of the pad for ghost-free reception is between 4 and 6 db. Except in critical areas of low signal strength, this loss is not troublesome. In critical areas, however, it is apparent that replacing the transmission line with one that matches the receiver may not only result in ghost-free reception, but in a signal increase of as much as 13 db. —30—

Table 3. Power losses in typical unmatched and matched systems.

RECEIVER IMPEDANCE (OHMS)	LINE IMPEDANCE (OHMS)				
	53	75	106	150	300
72	L_p = 5 L_m = 0.3 L_o = 4.7		L_p = 6 L_m = 0.6 L_o = 5.4	L_p = 8 L_m = 2.1 L_o = 5.9	L_p = 12 L_m = 6.9 L_o = 5.1
100	L_p = 7 L_m = 1.7 L_o = 5.3	L_p = 5 L_m = 0.4 L_o = 4.6		L_p = 6 L_m = 0.7 L_o = 5.3	L_p = 10 L_m = 4.5 L_o = 5.5
150	L_p = 10 L_m = 4 L_o = 6	L_p = 8 L_m = 1.9 L_o = 6.1	L_p = 5 L_m = 0.5 L_o = 4.5		L_p = 8 L_m = 1.9 L_o = 6.1
300	L_p = 13 L_m = 9 L_o = 4	L_p = 11 L_m = 6.5 L_o = 4.5	L_p = 10 L_m = 4 L_o = 6	L_p = 8 L_m = 1.9 L_o = 6.1	

L_p Power loss due to insertion of pads in db.
L_m Loss due to mismatch in db.
L_o Additional operating loss under matched (ghost-free) conditions in db.

UPRIGHT CAPACITORS

Fig.	Mfd.	Voltage	Terminals	Mfrs.	Price
B	1	600VDC	2	Aer	35c, 3 for $1.00
E	.25	400VDC	2		39c, 3 for 1.10
E	.5	600VDC	2	Solar	35c, 3 for 1.00
E	1	600VDC	2	Micamold	39c, 3 for 1.10
D	2x.5	600VDC	3	Solar	49c, 3 for 1.45
B	3x.1	600VDC	3	Gudeman	55c, 2 for 1.05
B	.25	400VDC	2	Aerovox	39c, 3 for 1.10
B	.5	600VDC	2	Solar	35c, 3 for 1.00
B	.5	600VDC	2	Aerovox	35c, 3 for 1.00
E	1	400VDC	2	CD.	35c, 3 for 1.00
B	.1	400VDC	2	Aero	40c, 2 for .75
B	.1	600VDC	2	Gudeman	39c, 3 for 1.10
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D	1	600VDC	2	Aero	50c, 2 for .95
B	2x.1	400VDC	2	CD.	35c, 3 for 1.00
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D	3x.1	600VDC	3	Gudeman	49c, 2 for .95
A	2x.5	600VDC	2	Aer	45c, 2 for .85
B	.1	600VDC	2	Aer	45c, 2 for .85
B	.1	600VDC	2	Gudeman	45c, 2 for .85
D	1	500VDC	2	G.E. Pyr	45c, 2 for .85
A	1	500VDC	2	G.E. Pyr	45c, 2 for .85
B	.1	600VDC	2	G.E. Pyr	45c, 2 for .85

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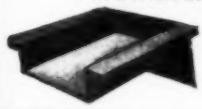

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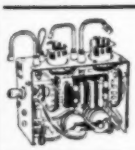

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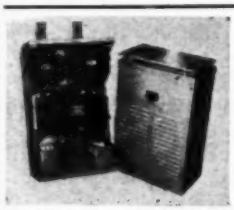

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C	.1	400VDC	2	@ 20c; 5 for .95
C	2X.1	600VDC	3	@ 29c; 3 for .85
E	.025	600VDC	2	@ 18c; 5 for .85
A	2	400VDC	2	@ 40c; 2 for .75
C	.1	600VDC	2	@ 25c; 4 for .95
E	2X.25	600VDC	3	@ 29c; 3 for .85
A	.5	1000VDC	2	@ 45c; 3 for 1.30
D	.1	600VDC	2	@ 25c; 4 for .95
E	3X.1	600VDC	3	@ 35c; 3 for 1.00
E	.5	200VDC	2	@ 20c; 5 for .95
C	.05	600VDC	2	@ 21c; 5 for 1.00
C	.5	600VDC	2	@ 25c; 4 for .95
C	.5	120VDC	2	@ 18c; 5 for .85
D	.1	600VDC	2	@ 20c; 5 for .95
E	4	50VDC	2	@ 25c; 4 for .85
E	1	400VDC	2	@ 25c; 4 for .95
D	1	600VDC	2	@ 30c; 3 for .75
C	3X.1	600VDC	3	@ 33c; 4 for 1.29
E	2X.25	400VDC	3	@ 27c; 4 for 1.05
D	.5	600VDC	2	@ 25c; 4 for .95
D	2X.1	600VDC	3	@ 29c; 3 for .85
E	.5	600VDC	1	@ 20c; 3 for .95
C	2X.1	200VDC	2	@ 20c; 5 for .95
C	.5	400VDC	1	@ 20c; 5 for .95
E	1	100VDC	2	@ 15c; 7 for 1.00
A	.02	1500VDC	2	@ 45c; 2 for .85
C	.5	600VDC	2	@ 25c; 4 for .95
C	.5	200VDC	2	@ 20c; 5 for .95
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11 mmf	±5%	240 mmf	±3%
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D	.00004	2500WVDC	Micamold	.39; 2 for .75
E	.000047	2500WVDC	Micamold	.39; 2 for .75
E	.01	500WVDC	Micamold	.25; 2 for .45
C	.002	3000WVDC	CD	1.05; 2 for 2.00
C	.01	2000WVDC	CD	1.50; 2 for 2.90
C	.00003	2000WVDC	Sang	.49; 2 for .95
C	.00009	3000WVDC	Spra	.75; 2 for 1.45
C	.00082	3000WVDC	Sang	1.00; 2 for 1.95
C	.002	3000WVDC	CD	1.00; 2 for 1.95
C	.005	5000WVDC	CD	1.65; 2 for 3.25
C	.004	6000WVDC	Sang	1.50; 2 for 2.95
C	.0006	3000WVDC	Spra	1.00; 2 for 1.95
C	.0008	3000WVDC	Spra	.95; 2 for 1.85
E	.0016	3000WVDC	Sang	.65; 2 for 1.25
E	.000090	3000WVDC	Sang	.40; 2 for .75
B	.08	1500WVDC	Sang	10.00; 2 for 19.50
B	.03	2000WVDC	Sang	12.00; 2 for 23.50
B	.045	2000WVDC	Sang	12.00; 2 for 23.50
B	.00015	20000WVDC	Sang	24.00; 2 for 47.50
B	.0001	20000WVDC	Sang	24.00; 2 for 47.50
B	.002	15000WVDC	Sang	19.00; 2 for 37.50
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Television Receivers
(*Continued from page* 66)

second detector. This means that the amplitude of the sound carrier should be reduced to about 5 per-cent of the maximum picture carrier amplitude. In order to achieve this, the i.f. system through which both signals pass is designed to have the response characteristic shown in Fig. 5. At the frequency of the sound i.f. carrier, the response curve is 26 db. down from the video carrier frequency point.

After passage through the i.f. system, the signals are fed to the video detector, where the i.f. frequencies are removed, leaving only the video frequencies, which extend from 0 to 4.0 mc. and the 4.5 mc. beat note that is produced when the two carriers beat against each other.

At the output of the video second detector, the complete signal, including the 4.5 mc. voltage, is usually passed through the video-frequency amplifiers. The sound signal, it must be remembered, was reduced considerably in the i.f. system and thus requires a corresponding increase in amplification following the video second detector in order to bring it back to a usable value. Even after passage through the video-frequency amplifiers, its average level seldom exceeds one or two volts. Thus, what is done is to transfer this voltage out of the video system into an audio i.f. amplifier, tuned to 4.5 mc., and after one stage of amplification, apply it to an FM detector for conversion into audio frequencies. Thereafter, one or two audio amplifiers bring the signal to the desired strength for normal operation of a loudspeaker.

We might pause and note here that the actual number of stages devoted exclusively to the sound signal is less in the Intercarrier system than in conventionally designed sets. This usually means a savings of two to three stages.

One way to remove the 4.5 mc. voltage from the video system is to employ a series resonant trap, connected from the plate of the final video-frequency amplifier to ground. See Fig. 6. The voltage developed across the coil is amplified by a 6BA6 4.5 mc. amplifier and then made available to the FM detector. Through the use of a series resonant circuit, essentially all of the 4.5 mc. voltage is removed from the video path and thereby does not reach the cathode-ray tube. The 6BA6 operates as a limiter and serves to present a fairly constant output when widely varying signals are applied to its input. This is desirable, especially if some form of tuning control is provided, otherwise the set user might attempt to tune for loudest sound, which would seriously distort the picture.

We are now in a position to appreciate fully the reasons for the reduction in sound carrier prior to the video second detector. First, if the video and

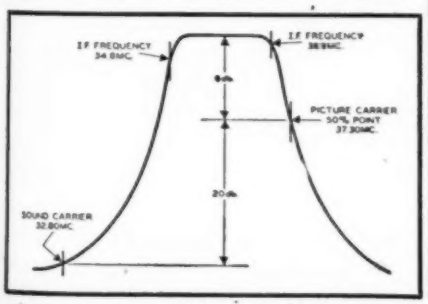
audio carriers are comparable in strength when they reach the video second detector, the resultant 4.5 mc. beat note will contain a considerable amount of amplitude modulation. Also, the amount of this amplitude modulation will vary as the modulation of the video carrier changes. Since no FM detector now in practical use is able to completely remove or ignore amplitude modulation in an FM signal, the audio output will be distorted to an extent dependent upon the amount of amplitude modulation present in the signal. Even the use of a limiter prior to the detector does not altogether alleviate this trouble. With the amplitude of the sound carrier equal to about 5 per-cent of the video carrier, the 4.5 mc. beat note amplitude remains substantially constant as the level of the video carrier varies between 15 to 100 per-cent of its peak value.

Another consideration in conjunction with the use of comparable audio and video carriers is the manner in which the audio voltage can affect the picture. The sound carrier, it is known, is frequency modulated and one way to convert an FM signal into an audio voltage is by means of slope detection. Now, if the sound signal receives 26 db. less amplification than the video signal in the i.f. system, it will be quite small and even if 30 per-cent of this signal suffers slope detection at the video second detector, the interference from this source will be approximately 33 db. below the video signal and generally unnoticeable. However, if the audio signal is large at the detector, then even 10 per-cent slope detection will produce enough audio voltage to develop horizontal bars across the screen. It will probably be found that with a large audio signal, more than 10 per-cent slope detection occurs, further aggravating the situation.

If the 4.5 mc. signal itself reaches the control grid of the cathode-ray tube, a fine line pattern will appear on the screen. This will occur if the audio signal is strong at the video detector output and does not receive the proper amount of attenuation. However, if the audio signal is reduced by the 26 db. specified above, then its effect, after the shunting effect of the series resonant pick-off circuit, will be so small as to be negligible.

Thus, we see from the foregoing why it is mandatory for the video car-

Fig. 8. The i.f. response curve of the Tele-Tone 7" receiver diagrammed in Fig. 7.



rier to be considerably stronger than the audio carrier, at the video detector, if the Intercarrier system is to function properly. It also explains why the presence of the sound signal, even as far as the last video-frequency amplifier, does not materially affect the image on the screen.

In receivers employing the conventional system, it has recently become common practice to insert a 4.5 mc. trap in the grid or plate circuits of the first video-frequency amplifier following the video second detector. This is done to prevent any 4.5 mc. voltage, which may be generated in the video detector from reaching the cathode-ray tube. In the mass production of many television receivers, the sound carrier may not receive the full attenuation required to suppress it completely. Hence this additional precaution.

To see how the Intercarrier system is applied commercially, let us analyze a receiver operating on this principle.

Tele-Tone Television Receivers

The *Tele-Tone 7"* receiver diagram is shown in Fig. 7. The front end of the receiver contains a 6AU6 r.f. amplifier, a 6AG5 mixer, and a 6J6 push-pull oscillator. Examining this section of the receiver briefly, we find that the antenna signal is fed between the grid and cathode of the r.f. amplifier in a balanced arrangement, against ground, so as to properly terminate a 300-ohm transmission line. The input circuit is untuned, the input coil, L_1, serving as part of a high-pass filter designed to permit all the television signal frequencies to pass but to attenuate extraneous signals at the i.f. frequency. For strong local signals, an attenuator pad is provided (not shown) to prevent overloading of the amplifiers with resultant distortion to the image and sound.

The plate circuit of the r.f. stage is tuned by what is, electrically speaking, a single tapped inductance. Mechanically, this coil takes the form of several individual coils which are cut in or out of the plate circuit by the rotary 12-position band switch.

The 6J6 oscillator is a push-pull arrangement with the coil for channel 2 (the present first channel) permanently in the circuit. For the remaining channels, 3—13, a second coil is placed in parallel with this coil, reducing the oscillator frequency to the proper value. Each coil is tuned by brass slugs accessible from the front panel. The output from the r.f. amplifier and the oscillator are condenser fed to the grid of the 6AG5 mixer tube. Additional transfer of energy by means of a single turn of link coupling is provided between the r.f. amplifier and the mixer for the upper channels.

The oscillator, in this receiver, operates above the incoming audio and video carriers on all channels. In Intercarrier sets this need not be true as we will see in a later set. The video carrier i.f. is 37.3 mc. and the sound carrier i.f. is 32.8 mc.

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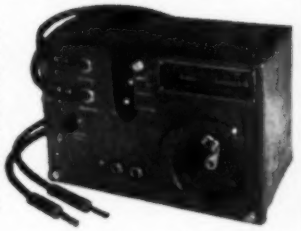

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Receiver transmitter with all parts, spares and coils.
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1625...3 for $1.10		5BP1 Scope tubes @	$2.50
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For the BC-348.....PLQ-103
For the BC-733.....PLQ-254
For 269-F Radio Compass Inverter, PL-3108-22-48
For the SCR-274-N ...PL-147, 148, 151, 152, 153, 154A, 156, 258
For the BC-375.....PL-59—PL-61—PL-64
For the ART-13.....U-8U, U-10U, U-16U
For the ARC-1.....U-15U, U-16U
MC-203A coupling Coax Fittings—.....PL-259A (83-1SP)-UG-21U-UG-22U
PL-164 M-359 U-11/U
AN-3108-28-19P
AN-3108-12S } Combination Male and
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The i.f. system contains 3 stages, two of which employ transformer coupling and the third impedance coupling. Each i.f. transformer has only one adjustment, a powdered iron slug accessible from the top of the chassis. The i.f. string is stagger-tuned to two frequencies, 34.8 mc. and 36.9 mc., resulting in the over-all response characteristic shown in Fig. 8. The curve is fairly flat-topped and the amplification accorded the sound carrier is 20 db. less than that received by the video carrier frequency. (The previous 26 db. figure specified would be a more desirable value. However, in commercial sets values from 18 to 26 db. will be found. With the smaller figure we obtain a larger sound voltage at the pick-off point and this can be used to advantage in designing the audio system. On the other hand, there are the pitfalls previously described when the sound carrier level approaches closer to the video signal amplitude.)

The video second detector is an AM half-wave rectifier, incorporating high-frequency compensation in order to maintain the circuit response for the high video frequencies and the 4.5 mc. beat frequency. The signals are amplified by one stage of video frequency amplification after which the sound carrier is tapped off the plate of the video amplifier by a 4.5 mc. trap and fed through a 4.5 mc. sound i.f. amplifier to a ratio detector, and then to the sound amplifier, audio output, and speaker. The coupling network between the plate of the video amplifier and the cathode-ray tube will pass most of the video frequencies but attenuate any of the 4.5 mc. voltage that may attempt to pass through. From the output circuit of this same video amplifier, a portion of the signal is also fed to a sync separator and d.c. restorer tube. Sync systems in Intercarrier television receivers are similar to the sync networks in conventional television receivers. The use of an Intercarrier sound system does not affect this portion of a television receiver.

A word about the 4.5 mc. take-off trap in the plate circuit of V_5, the video amplifier. At first glance the trap appears to be a parallel resonant circuit. However, the 2.2 $\mu\mu$fd. condenser, in conjunction with the coil and 68 $\mu\mu$fd. condenser across the coil, form a series resonant circuit at 4.5 mc. The 68 $\mu\mu$fd. condenser neutralizes enough of the inductance of the coil to which it is connected so that what inductance remains can resonate with the 2.2 $\mu\mu$fd. series condenser at 4.5 mc. The operation here is identical with the series resonant traps used in the video i.f. systems of some conventional television receivers. This was previously described in detail.

The *Tele-Tone* receiver uses an a.g.c. circuit controlling the r.f. and the first two i.f. stages. The a.g.c. voltage is developed by a separate diode section of the 6AL5; the other section of this tube is the video detector. It is important to remember, when aligning the i.f. system, that the sound carrier marker appears at a point which is roughly 20 db. down from the level of the video carrier. Furthermore, the video carrier should be 50 per-cent down (i.e. 6 db.) from the maximum amplitude of the response characteristic. Other receivers employing a similar circuit design are the *Sentinel* models 400-TV and 450-TVM receivers, the *National* model NC-TV7 receiver, and the *Hallicrafters* models T-54 and T-505.

(To be continued)

The radio service business is booming in the Tanganyika Territory as this picture will prove. H. S. Bharj of Moshi sent along this photo showing a friend of his catching up on his repair work on a Sunday. Because of a power failure that Sunday he had to do his soldering with a non-electric iron. The test equipment is British-made.

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800	2.25
801A	.98
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803	8.95
804	12.95
805	5.95
807	1.25
808	1.89
809	2.93
810	7.95
811	2.45
812	2.95
812H	6.90
813	8.95
814	3.95
815	2.95
816	1.19
826	.69
828	6.95
829A/B	7.95
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830	2.95
830B	5.25
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834	5.95
836	1.15
837	2.50
838	3.95
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849A	60.00
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930	1.10
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954	.75
955	.75
956	.75
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1608	4.95
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1614	1.75
1616	1.39
1619	.75
1620	4.95
1621	1.98
1622	1.75
1624	1.75
1625	.49
1626	.49
1628	4.95
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1634	.79
1635	1.10
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1851	1.25
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0A2	1.65
0A3/VR75	.98
0A4G	1.06
0B2	2.05
0B3/VR90	.75
0C3/VR105	.98
0D3/VR150	.75
OY4	.88
0Z4	.88
OZ4G	.88
01A	.50
1A3	.72
1A4	1.28
1A4P	1.56
1A5GT	.72
1A6	1.28
1A7GT	.80
1B3GT	1.49
1B4	1.56
1B5/25S	1.28
1B7GT	1.06
1C5GT	.88
1C6	1.28
1C7G	1.28
1D5GP	1.55
1D7G	1.28
1D8GT	1.56
1E5GT	1.38
1E7G	1.56
1F4	1.06
1F5G	1.06
1F6	1.56
1F7G	1.56
1G4GT	1.06
1G6GT	1.06
1H4G	.88
1H5GT	.66
1H6G	1.28
1H6GT	1.28
1J6GT	1.28
1L4	.80
1LA4	1.06
1LA6	1.06
1LB4	1.06
1LC5	1.06
1LC6	1.06
1LD5	1.06
1LE3	1.06
1LG5	1.06
1LH4	1.06
1LN5	1.06
1N5GT	.80
1P5GT	1.06
1Q5GT	1.06
1R4	1.06
1R5	.80
1S4	.96
1S5	.72
1T4	.80
1T5GT	1.06
1U4	.80
1U5	.72
1V	.88
2A3	1.28
2A4G	1.28
2A5	.88
2A6	1.06
2A7	1.06
2B7	.88
2V3G	1.98
2X2A	1.25
3A4	.39
3A5	1.49
3A8GT	1.98
3B7	.36
3D6	.36
3LF4	1.28
3Q4	.88
3Q5GT	.96
3S4	.80
3V4	.80
5AZ4	.50
5R4GY	1.15

Type	Price
5T4	$ 1.28
5U4G	.60
5V4G	.96
5W4	1.06
5W4GT	.66
5X4G	.72
5Y3GT	.42
5Y4G	.60
5Z3	.72
5Z4	1.06
6A3	1.28
6A6	1.06
6A7	.80
6A8	.80
6A8GT	.80
6AB5/6N5	.88
6AB7/1853	1.06
6AC5GT	1.16
6AC7/1852	1.16
6AD6	.88
6AD7G	1.28
6AF6	1.25
6AG5	1.06
6AG7	1.28
6AH6	1.56
6AJ5	.99
6AK5	1.56
6AK6	.96
6AL5	.80
6AL7GT	1.06
6AQ5	.80
6AQ6	.72
6AQ7GT	.88
6AR5	.96
6AS7G	4.95
6AT6	.60
6AU6	.80
6AV6	.60
6B4G	1.28
6B5	1.56
6B6G	.88
6B7	1.28
6B8	1.28
6B8G	1.28
6BA6	.80
6BE6	.72
6BG6G	1.92
6BH6	.80
6BJ6	.80
6C4	.39
6C5	.66
6C5GT	.66
6C6	.80
6C7	1.28
6C8G	1.28
6D6	.66
6D8G	1.28
6E5	.85
6E6	1.06
6F5	.66
6F5GT	.66
6F6	.80
6F6GT	.66
6F7	1.06
6F8G	1.28
6G6G	1.06
6H6	.60
6H6GT	.60
6J5	.54
6J5GT	.54
6J6	1.16
6J7	.80
6J7GT	.80
6J8G	1.28
6K5GT	.96
6K6GT	.60
6K7	.66
6K7GT	.66
6K8	.96
6K8GT	.96
6L5G	1.06
6L6	1.42
6L6G	1.16
6L6GA	1.16
6L7	.96
6L7G	1.16
6N6G	1.56
6N7	.96
6N7GT	.96
6P5GT	.96
6Q6G	1.06
6Q7	.80
6Q7GT	.72
6R7	1.06
6R7GT	1.06
6S7	1.28
6S7G	1.28
6S8GT	1.06
6SA7	.66
6SA7GT	.66
6SB7Y	.98
6SC7	.72
6SD7GT	.49
6SF5	.66
6SF5GT	.72
6SF7	.80
6SG7	.80

Type	Price
6SH7	$ 0.39
6SJ7	.66
6SJ7GT	.66
6SK7	.66
6SK7GT	.66
6SL7GT	.96
6SN7GT	.88
6SQ7	.60
6SQ7GT	.60
6SR7	.72
6SR7GT	.72
6SS7	.66
6ST7	.88
6SV7	.88
6T7G	1.24
6U5/6G5	.72
6U6GT	.72
6U7G	.72
6V6	1.28
6V6GT	.80
6W7G	.88
6X4	.60
6X5GT	.60
6Y6G	.96
6Y7G	.88
6Z7G	1.28
6ZY5G	.88
7A4/XXL	.72
7A5	.72
7A6	.72
7A7	.72
7A8	.72
7AD7	1.06
7AF7	.72
7AG7	.88
7AH7	.88
7B4	.72
7B5	.72
7B6	.72
7B7	.72
7B8	.72
7C4/1203A	.39
7C5	.72
7C6	.72
7C7	.72
7E5/1201	1.66
7E6	.72
7E7	.88
7F7	.88
7F8	1.06
7G7/1232	1.06
7H7	.80
7J7	1.06
7K7	1.06
7L7	.88
7N7	.88
7Q7	.72
7R7	.88
7S7	1.06
7V7	1.06
7W7	1.06
7X7 XXFM	1.06
7Y4	.72
7Z4	.72
10	.69
12A	.60
12A6	.39
12A6GT	.39
12A7	1.28
12A8GT	.80
12AH7GT	.88
12AL5	.80
12AT6	.60
12AT7	1.16
12AU6	.80
12AU7	.96
12BA6	.72
12BE6	.72
12C8	.69
12F5GT	.72
12H6	.39
12J5GT	.39
12J7G	.80
12J7GT	.80
12K7GT	.66
12K8	.88
12K8GT	.96
12Q7GT	.72
12SA7	.66
12SA7GT	.66
12SC7	.72
12SF5	.80
12SF5GT	.80
12SF7	.80
12SF7GT	.80
12SG7	.72
12SH7	.39
12SJ7	.66
12SJ7GT	.66
12SK7	.66
12SK7GT	.66
12SL7GT	.88
12SN7GT	.80
12SQ7	.60
12SQ7GT	.60
12SR7	.39

Type	Price
12SR7GT	$0.39
12X3	.98
12Z3	.88
14A7/12B7	.88
14AF7/XXD	.88
14B6	.88
14B8	.88
14C5	.88
14C7	.88
14E6	.72
14E7	.88
14F7	.88
14F8	1.06
14H7	.88
14J7	1.06
14N7	1.06
14Q7	.88
14R7	.88
14S7	1.06
14W7	1.06
14X7	1.06
14X4	.88
19	1.28
19T8	1.56
22	1.28
24A	.88
25A6	1.06
25A6G	1.06
25AC5GT	1.16
25L6GT	.66
25Y5	1.16
25Z5	.60
25Z6GT	.60
26	.72
27	.60
28D7	.39
30	.39
31	.39
32	1.28
32L7GT	1.28
33	.39
34	.38
35/51	.80
35A5	.72
35B5	.80
35L6GT	.66
35W4	.46
35Y4	.72
35Z3	.72
35Z4GT	.60
35Z5GT	.50
36	.39
37	.39
38	.39
39/44	.39
41	.66
42	.66
43	.66
45	.66
45Z3	.60
45Z5GT	.72
46	1.06
47	.96
49	.88
50	1.56
50A5	.88
50B5	.66
50L6GT	.66
50Y6GT	.72
53	1.06
56	.72
57	.80
58	.80
59	1.06
70L7GT	1.56
71A	.80
75	.66
76	.66
77	.66
78	.66
79	.88
80	.46
81	1.56
82	1.06
83	1.06
83V	1.28
84/6Z4	.72
85	.88
89	.72
89Y	.39
117L7GT	1.56
117M7GT	1.56
117N7GT	1.56
117P7GT	1.56
117Z3	.60
117Z4GT	1.16
117Z6GT	.96
FM-1000	1.28
UX120	1.38
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Regenerative Receiver

(*Continued from page 63*)

warmed up, turn the audio gain control to about the half-way position and then commence turning the regeneration control towards maximum position until a rushing noise or squeal is heard on the loudspeaker. The squeal would indicate that the set was tuned to exactly the same frequency as the carrier of some station. A slight decrease in regeneration control will remove the squeal and allow the station to be heard. Slight adjustment of the main tuning dial may be in order to get best reception. For reception of C.W. or Morse code signals, it will be necessary to set the regeneration control higher so that the squeal or chirping noise of the C.W. may be heard at all times. A little experience in adjusting this unit will allow the reception of many foreign broadcast stations and local and foreign amateurs. —30—

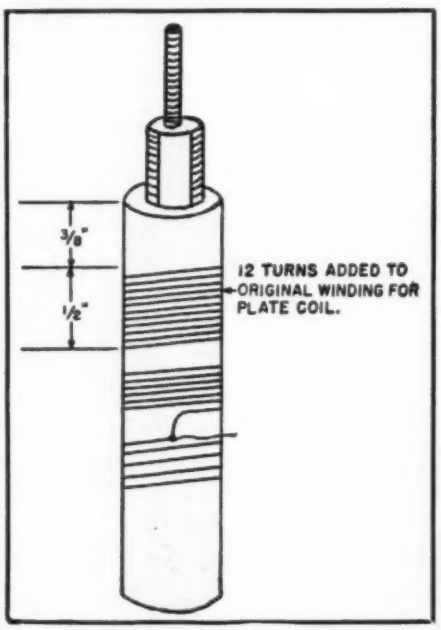
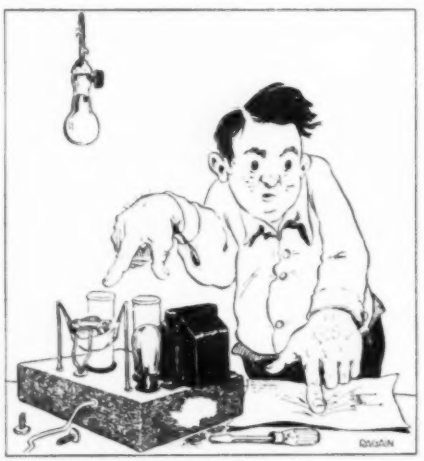


Fig. 5. Mechanical details of oscillator coil. Twelve turns are added, as shown above, to a Stanwyck S-231 coil.



"My, My. It does show a swinging choke!"

Technical BOOKS

"RADAR PRIMER" by J. L. Hornung. Published by *McGraw-Hill Book Company, Inc.*, New York. 213 pages. Price $3.50.

Although most persons probably think of radar only in terms of a military "weapon," in reality this warborn device is today filling many highly important civilian roles.

It is for this new segment of the population whose work deals with the various phases of radar that this book has been written. While the author has carefully adhered to the "primer" type of presentation and has avoided the use of technical terminology wherever possible, he doesn't "talk down" to his readers.

The book is divided into eight chapters which cover the fundamentals of radar, determining distance and direction, "electrons paint a picture," the basic parts of a radar set, radar at work, long distance navigation, microwaves and pulses, and the history of radar.

Airline employees and shipping line personnel will find this book of particular value because of the special emphasis placed on radar applications in these fields.

* * *

"THE RECORDING AND REPRODUCTION OF SOUND" by Oliver Read. Published by *Howard W. Sams & Co.*, 2924 E. Washington St., Indianapolis, Ind. 304 pages. Price $5.00.

The author has analyzed and appraised the host of circuits, equipment, accessories, and philosophies that have been developed about this extensive subject. An avid enthusiast on high fidelity recording and reproduction and a critical experimenter in all phases of the art, Mr. Read presents his material with the authority born of practical experience in his own laboratory, with all types of record-playback equipment. Noted for his easy-to-read style in rendering technical information, his presentation of all phases of this subject is accomplished with unusual clarity. Evolving his subject from a complete history of sound and the behavior of sound waves, the author fully covers all basic media for making recordings with a detached analysis of their respective merits. Auxiliary equipment is fully covered and amply illustrated in the text.

The handbook provides excellent coverage of acoustical systems for the reproduction of sound and a complete analysis of the various types of amplifiers, together with their individual applications.

* * *

"COYNE ELECTRICAL TROUBLE SHOOTING MANUAL" by The Coyne Staff. Published by *Coyne Electrical Radio School*, Chicago. 626 pages. Price $6.95.

Almost the entire 626 pages of this manual are devoted to wiring diagrams of equipment which the average industrial technician is likely to encounter in his work. The manual is divided into six main sections dealing with basic electricity, transformers, motors, controls, generators and converters, and electronics. These sections are further divided into divisions and applications.

According to the plan worked out by the authors, an electrician confronted by the problem of repairing a two-step magnetic controller for a d.c. motor would first consult the "subject matter" section of the "subject and application guide." After determining that the work falls into the "controls" classification, the user then breaks down the subject still further by selecting the subject "d.c. motors" under the main "control" classification. The "d.c. motors" category is subdivided and the user would select "magnetic, multi-step" as the application pertinent to the problem at hand.

Men whose daily work involves the repair, maintenance, and installation of all types of industrial electronic equipment will find this manual a help in cutting servicing time. —30—

Beginning Amateur

(*Continued from page* 45)

doesn't even read it. Instead, he gives the application form back to the applicant and tells him to have it notarized. (One or more notaries can always be found in or near a Federal building.) All the papers are then forwarded to Washington for grading. Notification of passing takes the form of the actual amateur license, with call letters marked on it. Failure brings only a form letter of regret. The usual wait for a license is about a month; for the less welcome notice, a couple of weeks. You cannot ask for specific call letters; you have to take what comes along.

The brand-new ham is eligible only for licenses of the Class B and Class C type. These involve the identical examination, but the difference lies in the manner of giving it. If you live within 125 miles of an FCC office or a point at which amateur tests are held periodically, you must appear in person and be checked by an FCC engineer, as described. If you live more than 125 miles from an examining point, you can obtain all the papers by mail from the nearest FCC office. You must arrange with a licensed operator to give you a code test and to certify that you answered the written part of the examination in his presence, without assistance. The government puts you on your honor in this deal! If you move into an area served by an FCC office less than 125 miles away, you must appear for an official re-examination within four months.

Class B and C licenses permit the holders to operate c. w. on any amateur band and phone above 27,160 kilocycles. The Class A license allows, in addition, the privilege of working phone in the so-called "20- and 75-meter" bands. Only hams with a minimum of one year's experience can apply for this license, which boasts a much stiffer examination than the

FCC offices where complete information on obtaining amateur licenses may be obtained.

RADIO DISTRICTS

Radio district	Address of the inspector in charge Federal Comm. Comm.	Territory within district	
		States, etc.	Counties
1	Seventh Floor Customhouse, Boston 9, Mass.	Connecticut	All counties.
		Maine	Do.
		Massachusetts	Do.
		New Hampshire	Do.
		Rhode Island	Do.
		Vermont	Do.
2	748 Federal Bldg., 641 Washington St., New York 14, N. Y.	New Jersey	Bergen, Essex, Hudson, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Passaic, Somerset, Sussex, Union and Warren.
		New York	Albany, Bronx, Columbia, Delaware, Dutchess, Green, Kings, Nassau, New York, Orange, Putnam, Queens, Rensselaer, Richmond, Rockland, Schenectady, Suffolk, Sullivan, Ulster and Westchester.
3	Room 1200, New United States Customhouse, 2d and Chestnut Sts., Philadelphia 6, Pa.	Delaware	Newcastle.
		New Jersey	Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Ocean, and Salem.
		Pennsylvania	Adams, Berks, Bucks, Carbon, Chester, Cumberland, Dauphin, Delaware, Lancaster, Lebanon, Lehigh, Monroe, Montgomery, Northampton, Perry, Philadelphia, Schuylkill, and York.
4	508 Old Town Bank Bldg., Gay St. and Falsway, Baltimore 2, Md.	Delaware	Kent and Sussex.
		District of Columbia	All.
		Maryland	All counties.
		Virginia	Arlington, Clark, Fairfax, Fauquier, Frederick, Loudoun, Page, Prince William, Rappahannock, Shenandoah, and Warren.
5	Room 402, New Post Office Bldg., Norfolk 10, Va.	North Carolina	All except district 6.
		Virginia	Do.
6	411 Federal Annex, Atlanta 3, Ga.	Alabama	All except district 8.
		Georgia	All counties.
		North Carolina	Ashe, Avery, Buncombe, Burke, Caldwell, Cherokee, Clay, Cleveland, Graham, Haywood, Henderson, Jackson, McDowell, Macon, Madison, Mitchell, Polk, Rutherford, Swain, Transylvania, Watauga, and Yancey.
		South Carolina	All counties.
		Tennessee	Do.
	Suboffice, Post Office Box 77, 214-218 Post Office Bldg., Savannah, Ga.		

(*Continued on page* 110)

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1mfd.	600v	.37	15mfd.	2000v	4.97
2mfd.	600v	.37	4mfd.	2500v	3.97
4mfd.	600v	.57	2mfd.	2500v	2.47
8mfd.	600v	1.07	.1mfd.	2500v	1.27
10mfd.	600v	1.17	25mfd.	2500v	1.47
3x.1mfd.	1000v	.47	.5mfd.	2500v	1.77
.25mfd.	1000v	.47	.05mfd.	3000v	1.97
1mfd.	1000v	.57	.1mfd.	3000v	2.27
2mfd.	1000v	.67	.25mfd.	3000v	2.67
4mfd.	1000v	.87	1mfd.	3000v	3.47
8mfd.	1000v	1.97	12mfd.	3000v	6.97
10mfd.	1000v	2.07	2mfd.	4000v	5.97
15mfd.	1000v	2.27	1mfd.	5000v	4.97
20mfd.	1000v	2.97	.1mfd.	7000v	2.97
24mfd.	1500v	6.97	3mfd.	4000v	6.97
.1mfd.	1750v	.87	2mfd.	3000v	3.47
.1mfd.	2000v	.97	2x.1mfd.	7000v	3.27
.25mfd.	2000v	1.07	.02mfd.	12000v	9.97
.5mfd.	2000v	1.17	.02mfd.	20000v	11.97

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1N23	.77	802	2.97	1LN5	.67
1N34	1.37	803	4.87	1Q5GT	.97
1P24	.87	805	3.97	1R5	.67
2AP1	2.87	807	1.07	1S4	.67
2C21	.27	808	1.57	1S5	.57
2C22	.17	809	1.67	1T4	.57
2C26	.27	810	4.97	3Q4	.57
2C34	.27	811	1.97	3Q5	.67
2C40	.97	812	2.37	5U4	.47
2C44	.67	813	5.87	5V3	.37
2C46	5.87	814	2.47	6A7	.57
2D21	1.07	815	2.47	6A8GT	.57
2J21	9.87	816	1.07	6AG5	.87
2J22	9.87	826	.47	6AG7	.97
2J26	9.87	829B	3.47	6B4G	.97
2J31	12.87	832A	3.47	6B6G	1.47
2J32	14.87	833A	29.97	6C6	.47
2J36	24.87	836	.97	6D6	.47
2J38	14.57	837	1.57	6F5GT	.47
2J39	18.47	838	2.67	6F6GT	.47
2J40	18.47	841	.47	6F6	.57
2J48	14.97	843	.37	6H6	.37
2J49	26.97	845W	3.87	6J5GT	.47
2J54B	18.97	851	14.97	6J7GT	.67
2J55	18.97	860	2.27	6K6GT	.47
2K25	23.97	861	9.97	6L6G	.97
2K28	8.97	864	.47	6L6	1.17
2V3G	.87	865	.67	6L7	.77
2X2	.37	866A	.97	6Q7GT	.57
3AP1	2.97	866JR	1.07	6SA7GT	.47
3BP1	1.37	869B	18.97	6SC7	.57
3B22	.57	872A	1.47	6SF5GT	.57
3B24	1.87	874	.67	6SH7	.47
3B26	.87	876	.37	6SJ7GT	.47
3CP1	2.67	878	1.17	6SK7GT	.47
3C21	3.97	884	.97	6SL7GT	.57
3C22	17.97	885	.87	6SN7GT	.57
3C23	2.47	902P1	4.97	6SQ7GT	.47
3C30	.47	905	1.87	6V6GT	.47
3C31	1.47	923	.87	6X5GT	.57
3DP1	1.47	954	.17	7A8	.67
3D21A	1.47	955	.37	7B7	.57
3E29	5.97	956	.37	7C5	.57
4B24	2.27	957	.27	7C6	.67
4E27	12.97	958	.27	7F6	.67
5AP4	3.97	1611	.97	7Y4	.67
5BP1	1.27	1613	.57	12A8GT	.57
5BP4	2.47	1616	1.37	12AT6	.47
5CP1	1.97	1619	.27	12AU6	.47
5D21	18.97	1624	.77	12AB6	.57
5FP7	1.37	1625	.27	12BE6	.47
5JP1	9.97	1626	.27	12J5GT	.47
5JP2	9.97	1629	.27	12J7GT	.47
5J29	14.97	1630	1.87	12Q7GT	.57
5J30	18.97	1636	3.97	12SA7GT	.57
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5Z4	.77	2051	.47	14A7	.57
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12GP7	12.87	9005	.57	35A5	.67
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211	.47	F660-A	39.47	42	.47
227A	2.97	FG81A	3.97	43	.57
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250R	7.97	FG238B	29.47	47	.77
250TH	19.47	GL146	7.97	50A5	.87
250TL	19.47	GL697	29.47	50B5	.57
304TL	.97	HY615	.37	50L6GT	.57
304TH	3.47	ML100	19.97	50Y6GT	.57
316A	.47	ML101	39.47	56	.47
327A	2.97	ML502	39.47	59	.97
350B	1.47	RK72	1.37	70L7GT	1.07
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559	.97	VR150	.67	80	.47
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703A	1.97	VU111	.37	82	.87
705A	1.67	0Z4	.67	83	.87
706CY	18.97	1A5GT	.47	83V	.87
715B	7.97	1A7GT	.57	84/6Z4	.67
715C	18.97	1H5GT	.57	89	.67
717A	.97	1N5GT	.57	117L7GT	1.17
721A	1.57	1LA4	.97	117P7GT	1.17
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25 hy @ 160 ma.	3.47	10 hy @ 250 ma.	2.47
12 hy @ 150 ma.	3.27	10 hy @ 200 ma.	1.97
25 hy @ 65 ma.	1.37	10/20 @ 85 ma.	1.57
.05 hy @ 15 amps	7.97	15 hy @ 125 ma.	1.47
1 hy @ 5 amps.	6.97	15 hy @ 100 ma.	1.37
4 hy @ 600 ma.	5.97	3 hy @ 50 ma.	.27
200 hy @ 10 ma.	3.47	30 hy Dual @ 20 ma.	1.47
600 hy @ 3 ma.	3.47	8/30 hy @ 250 ma	3.47
325 hy @ 3 ma.	3.47		

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RADIO HAM SHACK Inc.
189 GREENWICH STREET . NEW YORK, N. Y.

RADIO DISTRICTS (Continued from page 108)

Radio district	Address of the inspector in charge Federal Comm. Comm.	Territory within district: States, etc.	Territory within district: Counties
7	Post Office Box 150, 312 Federal Bldg., Miami 1, Fla. Suboffice, 409-410 Post Office Bldg., Tampa 2, Fla.	Florida	All except district 8.
8	400 Audubon Bldg., New Orleans 16, La.	Alabama	Baldwin and Mobile.
		Arkansas	All counties.
		Florida	Escambia.
		Louisiana	All counties.
		Mississippi	Do.
		Texas	City of Texarkana only.
9	404 Post Office Bldg., Galveston, Tex.	Texas	Arkansas, Brazoria, Brooks, Calhoun, Cameron, Chambers, Fort Bend, Galveston, Goliad, Harris, Hidalgo, Jackson, Jefferson, Jim Wells, Kenedy, Kleberg, Matagorda, Nueces, Refugio, San Patricio, Victoria, Wharton, and Willsey.
10	Post Office Box 5238, 500 U. S. Terminal Annex, Dallas 2, Tex.	New Mexico	All counties.
		Oklahoma	Do.
		Texas	All except district 9 and the city of Texarkana.
11	539 U. S. Post Office and Courthouse Bldg., Temple and Spring Sts., Los Angeles 12, Calif.	Arizona	All counties
		California	Imperial, Inyo, Kern, Los Angeles, Orange, Riverside, San Bernardino, San Diego, San Luis Obispo, Santa Barbara, and Ventura.
	Suboffice, 307 U. S. Customhouse and Courthouse Bldg., Union and "F" Sts., San Diego 1, Calif.	Nevada	Clarke.
12	328 Customhouse, San Francisco 26, Calif.	California	All except district 11.
		Nevada	All except Clarke.
13	805 Terminal Sales Bldg., Portland 5, Oreg.	Idaho	All except district 14.
		Oregon	All counties.
		Washington	Wahkiakum, Cowlitz, Clark, Skamania, and Klickiatt.
14	808 Federal Office Bldg., Seattle 4, Wash.	Idaho	Benewah, Bonner, Boundary, Clearwater, Idaho, Kootenai, Latah, Lewis, Nez Perce, Shoshone.
		Montana	All counties.
		Washington	All except district 13.
15	504 Customhouse, Denver 2, Colo.	Colorado	All counties.
		Utah	Do.
		Wyoming	Do.
16	208 Uptown Post Office and Federal Courts Bldg., 5th and Washington Sts., St. Paul 2, Minn.	Minnesota	Do.
		Michigan	Alger, Baraga, Chippewa, Delta, Dickinson, Gogebic, Houghton, Iron, Keweenaw, Luce, Mackinac, Marquette, Menominee, Ontonagon, and Schoolcraft.
		North Dakota	All counties.
		South Dakota	Do.
		Wisconsin	All except district 18.
17	809 U. S. Court House, Kansas City 6, Mo.	Iowa	Do.
		Kansas	All counties.
		Missouri	Do.
		Nebraska	Do.
18	246 U. S. Court House, Chicago 4, Ill.	Illinois	Do.
		Indiana	Do.
		Iowa	Allamakee, Buchanan, Cedar, Clayton, Clinton, Delaware, Des Moines, Dubuque, Fayette, Henry, Jackson, Johnson, Jones, Lee, Linn, Louisa, Muscatine, Scott, Washington, and Winneshiek.
		Wisconsin	Columbia, Crawford, Dane, Dodge, Grant, Green, Iowa, Jefferson, Kenosha, Lafayette, Milwaukee, Ozaukee, Racine, Richland, Rock, Sauk, Walworth, Washington, and Waukesha.
19	1029 New Federal Bldg., Detroit 26, Mich.	Kentucky	All counties.
		Michigan	All except district 16.
		Ohio	All counties.
		West Virginia	Do.
	Suboffice, 541 Old Post Office Bldg., Cleveland 14, Ohio.		
20	328 Federal Bldg., Buffalo 3, N. Y.	New York	All except district 2.
		Pennsylvania	All except district 3
21	609 Stangenwald Bldg., Honolulu 1, Territory of Hawaii	Territory of Hawaii	
		Guam	
		Midway	
		Wake	
		American Samoa	
22	Post Office Box 2987, 322-323 Federal Bldg., San Juan 13, Puerto Rico.	Puerto Rico	
		Virgin Islands	
23	Post Office Box 1421, 7-8 Shattuck Bldg., Juneau, Alaska.	Alaska	

others. Also, you must appear in person for the Class A test, regardless of where you live.

One of the things not generally known about the licensing procedure is that an applicant can take the test in person at any FCC office giving it, regardless of where he lives. For instance, your permanent home might be Illinois, but you are attending school in New Haven. If you should happen to be in Boston or New York or Washington during a school vacation period, you can march into the FCC offices there and take your exam. These three big offices hold "open house" Monday through Friday, from about 9 a. m. to 5 p. m. At other offices the tests are given less frequently; two or three times a week at some, once a year at others. It pays to inquire beforehand.

And talking of paying. Never in the history of government control of radio, dating back to 1912, has there been a fee attached to the ham ticket. You do have to pay out a quarter to the notary public, but that's a private matter.

The FCC has twenty-three district offices, whose locations are given in the accompanying table. When you think you're ready for the ham test, write, phone or visit the one nearest you and ask about the license schedule. If you write, type or print your name and address clearly. Then practice the code some more, brush up on the theory, put an extra quarter in your shoe, and get going! *(To be continued)*

New 1949 Diagram Manual Added to Supreme Publications

NEW MANUAL COVERS ALL POPULAR 1949 SETS

Use this new manual to repair quickly all modern 1949 radio receivers. In this big, single volume, you have clearly printed, large schematic diagrams, needed alignment data, replacement parts lists, voltage values, and information on stage gain, location of trimmers, and dial stringing for almost all recently released sets. A worthy companion to the 8 previous volumes used by over 123,000 shrewd radio servicemen. Like the previous volumes illustrated above, it sells at a give-away price and gives you a whole year of radio diagrams for a couple of dollars total cost — nothing else to buy the rest of the year, nothing else to pay. Giant size: 8½ x 11 inches. Includes complete index. Manual style binding. Available at your jobber, or send coupon, price only... **$2.50**

Models Made by:

R.C.A., Zenith, Philco, Sears, Fada, Emerson, Belmont, Detrola Radio, Majestic, United Motors, Westinghouse, Admiral, Arvin, Stewart-Warner, Delco, Stromberg-Carlson, Western Auto, Wards, Sparton, Crosley, Motorola, Gamble, G.E., and many others.

AMAZING BARGAIN IN SERVICE DATA

Compiled by M.N. Beitman, radio engineer, teacher, author & serviceman.

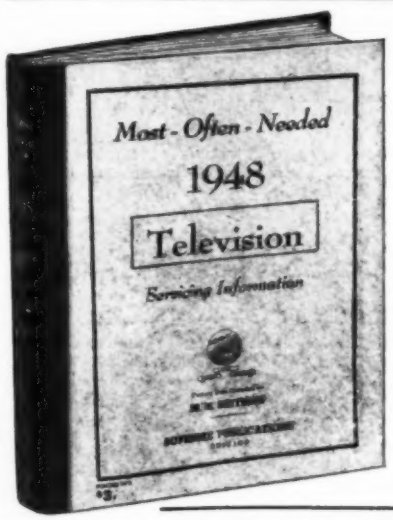
Here is your low-priced, money-saving source of radio diagrams and service information for all popular sets. Above is a photograph of these giant-size manuals — available to servicemen at only $2 for most volumes. Let these easy-to-use manuals guide you to quick fault-finding and simplified repair of any radio. Eliminate guesswork, cut hour-wasting jobs to pleasant moments. For 16 years, radiomen expected and received remarkable values in **Supreme Publications** service manuals. Yes, these manuals are still only $2 each, and only $2.50 for the new 1949 manual and the extra large 1926-38 volume. Biggest bargain in service manuals. Only a publisher who sold over a million manuals can offer such values based on tremendous volume-sales. Sold by all radio jobbers. **No-risk** examination granted to servicemen.

RADIO SERVICING COURSE-BOOK

Here is your practical radio course of 22 easy-to-follow lessons. Review fundamentals, learn new servicing tricks, all about signal tracing, use of oscilloscope, recording, test equipment P.A., and T-V. Just like a $100 correspondence course. Covers every topic of radio servicing. With self testing questions and index. Large size: 8½ x 11 in. Order by mail or see course-manual at your radio jobber, price only..... **$2.50**

FIND ALL RADIO FAULTS DOUBLE-QUICK

You can speed-up and simplify radio repairs with **Supreme Publications** manuals. Service all radios faster, better, easier, save time and money, use these **most-often-needed** diagram manuals to get ahead, earn more per hour. These manuals cover every popular radio of all makes, from old timers to new 1949 sets. Clearly printed circuits, parts lists, alignment data, and helpful service hints are the facts you need to be more expert in radio servicing. Save hours each day, every day, begin to earn more by making repairs in minutes instead of hours. Let these inexpensive manuals give you needed diagrams for 80% of all sets. These manuals pay for themselves with time saved on a couple of jobs, after that you use them FREE. There are nine volumes in all as illustrated above. Each manual is 8½ x 11 inches, sturdy manual style binding, average manual has 194 pages of diagrams and practical service data. Use coupon below to order on trial.

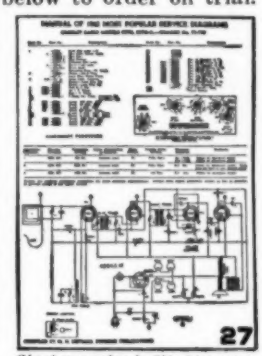


New 1948 T-V Manual

New, giant volume of television factory data covers every popular make. Gives description of circuits, pages of test patterns, response curves, alignment facts, oscilloscope waveforms, voltage charts, service hints, many diagrams in the form of double-spread blueprints, test points, everything to bring you up to date and make you expert in all T-V repairs. Large, sturdy 8½"x11" manual style binding, flexible covers, price only..... **$3**

SENSATIONAL LOW PRICES

Be money ahead with SUPREME manuals. For the amazing bargain price (only $2 for most volumes) you can be certain of having in your shop and on the job, needed diagrams and other essential repair data on 4 out of 5 sets you will ever service. There is no need to spend large sums for bulky, space-wasting manuals of other publishers, or to buy additional drawings every few weeks; be wise, use SUPREME Manuals to get the most in diagrams for the smallest cost. Check manuals wanted below.



Giant page size is 8½x11 inches

F.M. and Television Manual (1947)

Manual of instructions for trouble-shooting, repairing, and alignment of all popular 1947 F.M. and Television sets. Covers every popular make; includes AM-FM combinations, F.M. tuners, and all types of T-V receivers. This is the material you need to adjust and fix any modern F.M. and T-V set. Data on 192 large pages, 8½x11". Sturdy, manual style binding. At your jobber or by mail; your price, only..... **$2**

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Name: .....

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Supreme Publications

Available at the Better Radio Jobbers Everywhere

Grid Dip Adapter

(*Continued from page* 61)

od, without the use of additional equipment.

We have made reference to the probe and probe coils throughout the preceding text. The photograph of Fig. 1 shows the internal construction of this unit, component placement, and the socket mounting layer construction. The whole unit is mounted inside the small convenient tubular can. This permits measurement in the tightest places without any difficulty.

Energy Indicator

Another important application of 915 is that of a non-oscillating detector. In this case, the back plate terminals are shorted across, to provide a d.c. return for the rectifier. Under this heading may be listed the important functions of absorption-type frequency meter, field strength meter, and monitor, to mention only a few. The coupling in this case is the same as previously mentioned. The meter will read upward as we are taking energy from the specimen circuit. With an external calibration chart, it is possible to use this instrument as a db. meter for receiver or fixed line work. This, again, represents just a few of the many different applications that may be performed when using it in the de-energized condition.

Measurement of Capacitance and Inductance

The value of any capacitance, within practical limits, may be quickly determined. Model 915 is again connected to the companion signal generator, as in the dip application. To make capacitance measurements properly, it is necessary to have a good high-value, variable condenser with an associated calibration scale. This scale should indicate the actual capacitance change vs. degrees rotation. In parallel with the condenser should be an air-wound coil. Determine first the resonance of this combination circuit with the variable condenser at maximum setting. Leave 915 loosely coupled to the circuit coil and shunt the specimen condenser across the variable condenser. Retune the variable condenser until resonance is again indicated by the 915 meter. The value of the unknown condenser is the difference between the two readings on the calibrated scale. For example, if the circuit was resonant at some frequency with a maximum setting of 500 $\mu\mu$fd., and could be re-resonated (after the specimen had been added) at a setting of 430 $\mu\mu$fd., the unknown value would be 70 $\mu\mu$fd. A similar method may be utilized to determine, by a series additive system, the exact value of inductors. These units may be constructed if desired. The value of either type of measurement is directly related to the tolerance of the calibration scale.

A separate associated unit is available to perform these measurements exactly. This unit is Model 917, and consists of a capacitance and inductance standard. Both standards are accurately calibrated and completely variable throughout all practical ranges.

The preceding discussion has outlined some of the application merits of a new and very unique instrument. To the engineer, technician, and production worker, it represents a quick solution to many design and testing problems. To the serviceman, it is a means of aligning and checking all receivers rapidly. The amateur reader has probably realized that his v.f.o. is the signal generator described, and may be used as a coupling source for transmitter alignment, parasitic and oscillator checking, etc. It is our opinion that once you have used an instrument of this type, you will find it indispensable. —30—

TISA PLANS CAMPAIGN

AT a special meeting of the Television Installation and Service Association (TISA) of Chicago, a program was drawn up which is designed to promote the betterment of the professional serviceman.

Specific goals outlined were the establishment of adequate technical standards, installation and service rates, advanced training of personnel, owner education, and better relations with the industry.

The officers of the TISA, Frank J. Moch, president; Irving Kaluzna, vice-president; Fred Levine, secretary; and Philip Bann, treasurer, hope to hear from other units regarding mutual problems. Questions should be addressed to the association offices at 3125 West 59th Street, Chicago 29, Illinois. —30—

VISUAL CODE COURSE

RECENTLY, Mr. Otto H. Luther of New Preston, Connecticut, designed a rather novel system for learning the Morse code alphabet. This method enables the student to associate the code symbols with the already familiar appearance of the letter, by means of superimposing the dots and dashes on the letters themselves in an amusing and colorful way.

For instance, the letter "I" is represented by a diagram of two bulls eyes with large red-dot centers. Under this appears the memory key word "EYES." Obviously, two dots stand for the letter "I," and you don't easily forget it.

According to Mr. Luther, a commercial artist, who sells it, this color chart system will shorten code learning time drastically, and it is not unusual for a student to master it in an hour. —30—

Manufacturers' Literature

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO & TELEVISION NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

CONVERTER CATALOGUE

The complete line of *Carter* converters is presented in a new catalogue which is designed to furnish complete information in great detail to those who buy, sell, use, or service the company's products. The literature is presented in a convenient form, best suited to the needs of engineering and purchasing departments.

The bulletin consists of 16 illustrated pages on the entire range of available input and output voltages, including the recently perfected designs to be used in conjunction with television operations, as well as those for recording, sound projection, and mobile communications applications.

Also included is a *Carter* Selector Chart, augmented to include new television and recording equipment for which these converters are adapted. The chart shows at a glance the correct converter required to operate each popular make and model. A complete list of sales representatives is also supplied, and a convenient index is included.

Inquiries for the "Converter Catalog No. 349" should be addressed to *Carter Motor Company*, 2644 N. Maplewood Avenue, Chicago, Illinois.

TV ANTENNA BOOKLET

An eight-page catalogue recently put out by the *Workshop Associates, Inc.*, 66 Needham Street, Newton Highlands 61, Mass., amply illustrates the company's line of television antennas, mounts, etc.

Sections are devoted to the *Workshop* high-gain antennas, masts, and mounts, as well as high-gain arrays, transmission line, connectors, transformers, and typical antenna arrangements. Complete specifications are given for the products, together with prices. Television reception problems are covered, and the suggestions should be welcomed by the servicemen who must experience them.

This catalogue, Number 49, is obtainable free of charge by writing to the *Workshop Associates, Inc.*, in Massachusetts.

STANDARD TERMINOLOGY

Recent scientific developments in ultrasonics, recordings, underwater sound, acoustical instruments, and shock and vibrations are reflected in the Proposed American Standard Acoustical Terminology, being published for a period of trial study before its final approval. The American Standards Association has made every effort to keep the definitions consistent with those in standards relating to neighboring fields, and each term is as completely defined as possible.

The committee working on the terminology took into consideration such recent developments as the widespread use of the term "supersonic" for speeds higher than the velocity of sound following its use in this sense during the war. As a result, the term "ultrasonic" has been defined as indicating sounds having frequencies beyond the upper pitch limit. Studies of underwater sound phenomena also showed the need for a broader definition of "reverberation" as the types of reflections from boundaries under water differ from those received in a room.

Workers in theoretical and applied acoustics and all others interested are invited to send comments on the proposed terms to the committee in charge not later than September 30, 1949. Address Messrs. E. Dietze or C. F. Wiesbusch, *Bell Telephone Laboratories, Inc.*, Murray Hill, N. Jersey. Copies of the standard, Z24A, can be obtained from the American Standards Association, 70 East 45th Street, New York 17, N. Y., at $1.00 each.

BROADCAST MICROPHONES

Electro-Voice, Inc., Buchanan, Michigan, has developed two new ultra-wide-range, high-fidelity microphones (Models 645 and 650) designed for the FM and AM broadcast services and has released a new bulletin, Number 144, giving all necessary data on these models.

The bulletin explains the various performance and construction features, with detailed specifications, and is illustrated with photographs and sketches.

A copy may be obtained by writing to the company at Buchanan, Michigan.

SOLDERING TECHNIQUES

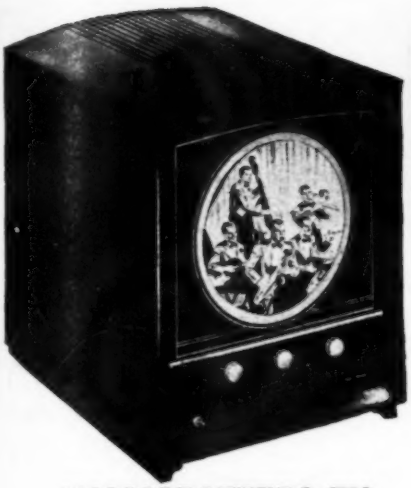
The 28-page technical manual entitled "Solder and Soldering Technique," published by the *Kester Solder Company*, contains an analysis of the properties and application of soft solder alloys and soldering fluxes.

Contents include the general nature of soldering, its application, the melting points and properties of solder and solder alloys, and information on how to utilize the company's technical and industrial service.

Write the *Kester Solder Company*, Technical Department, 4201 Wrightwood Avenue, Chicago 39, Illinois, for free copies of this manual.

GAUGE HANDBOOK

A combination catalogue, price list, textbook, and reference manual has been announced by *The Sheffield Corporation* of Dayton 1, Ohio. It is an



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Here's Television at a price, with all the big set features. 12 channel push button tuning. Static free FM sound reception and 23 sq. in. screen. 18 tubes plus 4 rectifiers. Shpg. Wt. 50 lbs.

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Model T-64 Chassis unit only of Model 509. Completely wired and tested, but less picture tube. Only

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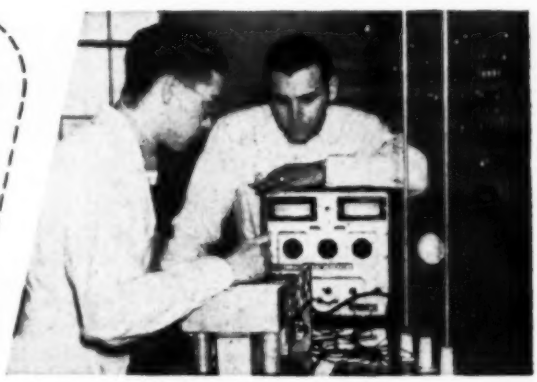

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TULSA, OKLAHOMA

illustrated bulletin of factual information for the buyers and users of precision gauges and includes prices, complete specifications, diagrams, and tables.

This 116-page catalogue is among the first to present information and prices on gauges conforming to the new, unified screw thread system recently agreed upon by the English speaking countries using the inch as a standard of measurement.

Sheffield representatives throughout the United States and Canada have been given a supply to distribute to their customers, and copies may be had free of charge by any user of gauges by writing to *The Sheffield Corporation,* Dayton 1, Ohio, on business stationery.

BI-MONTHLY "TECHNI-TALK"

The Tube Division of the *General Electric Company* has announced a new magazine called "Techni-Talk," which is designed to keep servicemen and dealers abreast of the latest developments in radio and television and to assist them with technical problems encountered in the field.

This bi-monthly illustrated publication features in the first issue (February-March) the beginning of a group of articles on the installation and servicing of television receivers. This issue also carried an article on the volt-ohm-milliammeter, the first of a series to help the serviceman get the most out of a minimum of test equipment.

"Techni-Talk" is distributed to the dealer or serviceman without cost but is obtainable only through *General Electric* or *Ken-Rad* distributors and not direct from the company.

PRINTED CIRCUITS

"Here is the Story," a booklet issued by *Microcircuits Company,* describes briefly their printed circuits and lists a number of branches of electronics in which these have been utilized.

The catalogue also illustrates the *Microcircuits Company* line of conducting, resistance, and magnetic paints, and the uses to which the paints may be put by repairmen, amateurs, engineers, designers, teachers, operators, and students. Also given are the order numbers, current prices, and pertinent technical data on each product.

The bulletin may be obtained without charge by writing to *Microcircuits Company,* New Buffalo, Michigan.

SERVICING YEARBOOK

Philco Corporation has published a yearbook containing servicing information on its 1946 and 1947 home radios and radio phonographs. This book, available to dealers and independent servicemen, provides in one volume information previously contained in separate radio manuals, together with many additions.

The yearbook explains the *Philco* trouble-shooting procedure, showing alignment procedures, base views, schematic diagrams, circuit descrip-

tions, drive-cord drawings, and other servicing helps on the home radios, combinations, and portables. Conveniently indexed for handy quick reference, it is priced at $2.75.

Also released is another handbook containing complete service and replacement parts information for the *Philco Universal* model auto radios and custombuilt models for Studebaker, Chrysler, and Packard. The price of this manual is $1.50. Address *Philco Corporation*, Tioga and "C" Streets, Philadelphia 34, Pa.

NEW RELAY BULLETIN

The fifteen basic models of general purpose appliance, motor-starting, and telephone-type relays manufactured by the *Potter & Brumfield Sales Co.* are illustrated and described in their 1949 catalogue Number 149. From these 15 basic models, approximately 7,000 different specifications have been developed for the electronic industry.

The company announces that the booklet will be sent free of charge to firms requesting it on company letterhead. Address the *Potter & Brumfield Sales Co.*, 549 West Washington Boulevard, Chicago 6, Ill.

AUTO SPEAKER DATA

The Permoflux Corporation, 4900 West Grand Ave., Chicago, Ill., announces that its new chart, No. J-28, is available to those who write to them requesting a copy.

This company, one of the pioneer manufacturers of permanent magnet dynamic transducers, has accumulated a good deal of information on replacement speakers for practically all auto radio sets now in existence, and incorporated it into this chart. Any serviceman should find it helpful. Ask for Auto Speaker Chart, No. J-28. —30—

SPEED-UP OF BELL TV NETWORK

ADDITIONAL channels on the *Bell System's* television network between Philadelphia and Chicago will be available more than a month ahead of schedule, according to an announcement of the *American Telephone & Telegraph Company*.

Under this program, the present pair of circuits (which transmits television programs in opposite directions) will be supplemented by the three west-bound and one east-bound channels being made available. After the installation, scheduled for around the first of May, two of the west-bound channels will operate on a twenty-four-hour schedule, while the third will be available only after 6:00 p.m.

Between Monday and Friday, the single east-bound channel will be available only after 6:00 p.m. This circuit, however, will be placed in operation for television transmission at any time on Saturdays and Sundays, making it possible to bring week-end Midwest sports events to the East.

Occasional important television programs will also be accepted, on advance notice, for transmission southward between New York and Boston. These, in recent months, have been arranged to carry only north-bound programs.—30—

Frequency Meter—V.F.O.

(*Continued from page 57*)

the band perfectly, but when another condenser, also marked 20 $\mu\mu$fd., was substituted it was necessary to parallel it with a condenser marked 10 $\mu\mu$fd. to bring the band where it was desired. It is suggested that for C_3, three CRL CC20Z condensers in values of 2 $\mu\mu$fd., 5 $\mu\mu$fd., 10 $\mu\mu$fd. and one CRL CC25Z 20 $\mu\mu$fd. condenser be purchased and by cut and try methods, using the condensers in parallel, adjust the band exactly where it is desired. Of course, if a 15 or 25 $\mu\mu$fd. variable air trimmer condenser is used, the band can be centered after the unit is assembled. The disadvantage in the use of a trimmer adjustable from the outside is that there is always the possibility that it may be inadvertently changed.

The chassis is aluminum, 10" x 6" x 2", with welded corners, and a shallow tray also with welded corners and ½" deep was made in which the chassis just fits. This provides complete shielding. The tray is fastened to the chassis with six 6/32 screws, the chassis being threaded to receive them. Four rubber feet fastened to the bottom of the tray assist in eliminating vibration and possible scratching of your desk top.

Two holes are drilled in the removable bottom of the ECO box, both ¼" in diameter. The r.f. output lead from the ECO passes through one hole in which a *Millen* feed-through has been inserted. The positive high voltage lead and the hot filament lead go through the other hole. A rubber grommet is inserted in the matching hole in the chassis top through which these voltage leads pass. The four screw holes in the box are tapped to take 8/32 bolts. The box is then assembled on the chassis by inverting it and securing with 8/32 bolts passed upward through the chassis and the box top as shown in Fig. 2. The rubber grommets provide additional shock mounting.

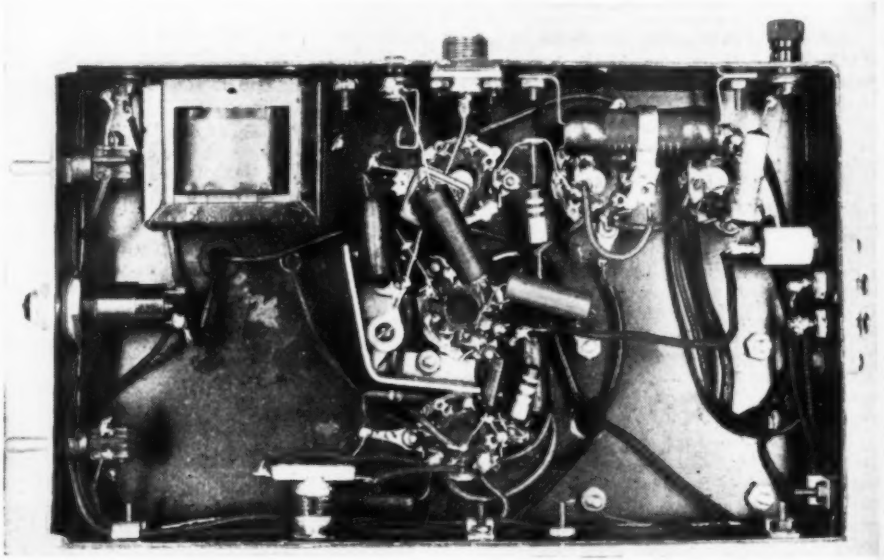
All wiring in the ECO box is made self-supporting and extremely rigid. Ceramic pillar stand-offs ¾" high are used to support the r.f. output and high voltage leads. Every nut in the entire unit has been lock-washered. This all adds up to increased stability. Under the chassis a small piece of aluminum was bent and placed as a shield between the 6F6 isolation stage and the 6L7 mixer tube as shown in the photographs. It was found better to use grid 3 (terminal 5) of the 6L7 to receive the output from the 6F6 isolation stage, and use grid 1 (cap) for r.f. input, than to reverse these grids.

As originally mentioned, this unit may be used both for transmitter frequency control and as an accurate heterodyne frequency meter for use with either your transmitter or your receiver. With a short pickup wire attached to the binding post and either headphones or a small PM speaker plugged into the phone jack it makes an excellent monitor for keying or note checking. It also functions as a monitor for your phone transmitter as due to the large band spread, zero-beating the carrier poses no problem.

At W1RBK, the transmitter with which this unit is used as a v.f.o. normally uses a 6L6 crystal oscillator in the usual series fed tetrode circuit. A coaxial terminal is connected in parallel with the crystal socket and a length of RG12/U connects the two units together when v.f.o. rather than crystal operation is desired. Obviously it is necessary to remove the crystal when using v.f.o., and to detach the RG12/U cable when using crystal control.

Some amateurs may have built up a Don Mix v.f.o. and later replaced it with a commercial model. In that case, the v.f.o. may be easily modified for use as a heterodyne frequency meter and thus retain its utility in the ham shack. —30—

Under-chassis view of home-built, dual-purpose frequency meter—v.f.o.



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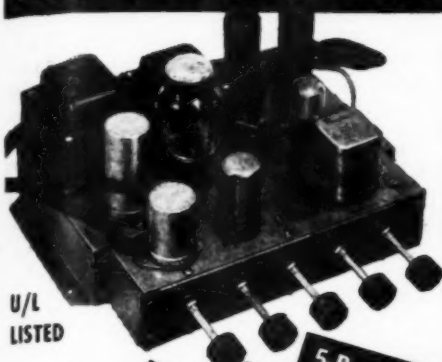

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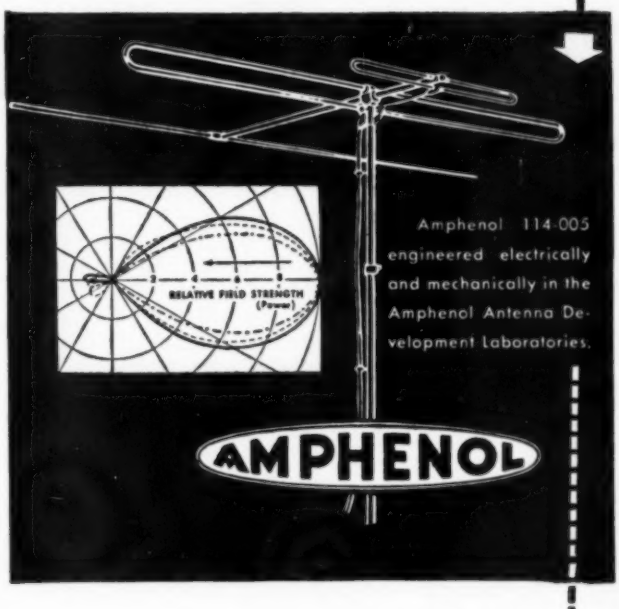
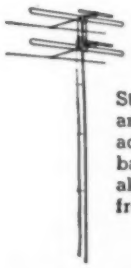
AMPHENOL TV ANTENNA



Streamlined and scientifically engineered for best reception and optimum gain, the Amphenol 114-005 Television Antenna incorporates two broadbanded folded dipoles and a low band reflector, with a common transmission line. Top performance is provided over all channels in both the high and low bands.

The radiation patterns as diagrammed are substantially unidirectional and maintain high front-to-back and front-to-side ratios over both bands.

The 114-005 is ideal for use with rotators.



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Briefcase Portable

(*Continued from page 55*)

Figs. 1 and 2 show the panel and chassis layouts respectively. The 140 $\mu\mu$fd. oscillator tuning condenser, C_{13}, is mounted on the front panel just to the right of the aluminum shield. Directly behind C_{13} is the 1.5 volt flashlight cell supported in a spring clip which affords easy replacement of the "A" source without removing the case. The antenna loading condenser, C_{12}, hidden in the top view by C_{13} (Fig. 2), can be seen mounted on the front panel in Fig. 1. Referring again to Fig. 2, the auxiliary antenna feedthrough insulator is just to the right of C_{12}. Directly behind the feedthrough is the oscillator tube followed by the oscillator final tank coil. The two XX30 45 volt "B" batteries, which neatly fill the remaining chassis space, are bolted in place by an aluminum strap.

Referring to the bottom view, Fig. 3, along the front panel from left to right are the microphone jack, J_1, S_1 which switches the microphone into the grid circuit of the 1T4, and the d.p.d.t. switch S_{2a}, S_{2b}. S_{2b} changes the "A" battery from the receiver to the transmitter while S_{2a} is the antenna changeover switch. Next in line is the headphone jack J_2, the "B" negative switch S_3, and the crystal socket.

RFC_1 is located just back of the microphone jack and S_1. To the right of the 1T4 socket, CH_1, the impedance choke, is mounted by the same screws which hold the output transformer, T_1, on top of the chassis. To the right is RFC_2 and C_{10}, the screen grid bypass condenser. Next is the final tank coil socket and directly in front is the 1S4 oscillator tube socket. Below the crystal socket is the feedback condenser, C_9, a fixed neutralizing condenser, which was salvaged from an SCR-274 N command transmitter. The plates are squeezed together to increase the capacity to the required value. To the left of the "C" penlite cells is the blocking condenser, C_{11}. From the left to right, along the back drop of the chassis, can be seen the 8 μfd. electrolytic, C_8, which is the feedback bypassing condenser, mounted on the terminal strip. The 1S4 audio tube socket is directly in front of C_8. Next is the closed-circuit meter jack, J_3, and the key jack, J_4. S_{3a}, S_{3b}, the modulator-c.w. changeover switch is mounted near the right hand end of the chassis.

Housing the unit was solved by salvaging the cabinet shield and base plate from the BC 456 modulator unit. This housing measures 3 x 4¼ x 9¾ inches over-all. The chassis was cut from the modulator base plate.

The unit is assembled by attaching the chassis to the panel with washers and nuts on the front panel switches. The cabinet is fastened with the screws and square rivet-head nuts originally used in the salvaged unit.

Adjustment and operation is by means of the front panel controls

shown in Fig. 6 and the switch on the back of the case shown in Fig. 5.

To adjust the receiver the filaments are lighted by turning the gain control switch clockwise. The plate voltage is then switched on and the regeneration control is advanced until a hiss is heard in the headphones. If no hiss is heard, there is probably insufficient feedback from the tickler coil, L_2. Some 1T4 tubes oscillate with difficulty and L_2 may require more turns. The oscillator tube should oscillate with approximately 30 volts on the screen grid. The receiver is set in the band by adjusting the bandset condenser, C_3, and securing a beat note in the home receiver. Receiver tuning is then performed with the bandspread condenser, C_4.

Adjusting the transmitter for c.w. operation is simple. Plug in the throw-out antenna and its loading coil, the meter, crystal, and key. Throw the "receive-send" changeover switch to the "send" position. With the key closed rotate the antenna tuning condenser to resonance as indicated by minimum dip on the meter. The antenna loading condenser is then turned clockwise with a screwdriver to the maximum increase in plate current. For best keying characteristics this increase, with the throw-out antenna, will be about 8 to 10 milliamperes. Check for resonance by readjusting the oscillator tuning condenser.

For phone operation, change the crystal to the desired phone frequency. Plug in the microphone and throw switch S_{2a} and S_{2b} to the "send" position. Remove the key to furnish plate voltage to the oscillator. Switch S_{2c} and S_{2d} is thrown to the "modulation" position and is left this way.

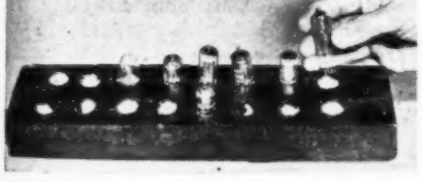
The regeneration control is fully advanced and the gain control then controls the modulation percentage. Further transmitter adjustments are the same as those described for c.w. operation.

The range of phone operation in open terrain, using the throw-out antenna, is about 5 miles, but c.w. stations hundreds of miles distant have been worked with a center-fed doublet home antenna. —30—

SUPPORT MINIATURES

WHEN the new miniature tubes are removed from the radio while tests or repairs are being made, some means of protecting these small tubes is needed.

A block of wood may have a number of holes—about three-fourths inch in diameter—drilled as shown to accommodate these tubes. The block shown is about 14 inches in length, 3½ inches wide, and 2 inches thick. The holes are around one inch in depth. . . H.L.



How to Prepare Your Article for Publication

Important rules to follow when submitting that manuscript—the editors will like it.

By

C. C. ERHARDT, W2HNJ

HOW many of you have felt impelled to submit a write-up on your favorite brain child only to let it slide with the thought—"Aw heck, they wouldn't publish any of the messy stuff I write." Well, brother, maybe they wouldn't; but on the other hand, maybe they would if you went about it properly.

As in any other field of endeavor, there are certain rules which must be observed in order to obtain satisfactory results. It is the purpose of this article to outline those rules and to make some suggestions for the aid of the embryo writer.

The important point to consider before doing any writing is this: Is your idea of genuine interest to the radio public? Does it contain fresh, unique features? If, for example, you were considering sending in a constructional article on "How To Build A Super-Duper Receiver," it would be a good idea to look through your back issues and make sure that the reader hasn't already been deluged with super-duper receivers. However, if you feel that you have something that is really good then it's up to you to make it into first class material for publication.

For the purpose of discussion, an article may be considered as consisting of three parts: 1. Manuscript. 2. Photographs. 3. Diagrams and sketches. Let's take them in that order.

A manuscript, of course, is the text or written portion of an article. Let me emphasize one thing right now. Don't ever submit a manuscript written in longhand! Whether it means hiring a public stenographer or swiping Cousin Effie's portable, make sure that your completed manuscript is typewritten.

Don't try to write in too flowery a style. Short, simple sentences are usually best. Avoid use of overworked phrases such as "due to the fact." It's much easier to say "because." Another dilly that crops up in radio articles and makes editors pull out their hair is—"the circuit is conventional in most respects." If your circuit is conventional don't say anything. Try to avoid having too many of your paragraphs begin with the word "the." This is a habit most beginning writers fall into as it is the easiest way to open a paragraph.

Remember, you are not competing for the Pulitzer Prize. Don't worry too much about spelling or grammatical structure. If they are too atrocious the editorial staff will fix 'em up. What they are mostly interested in is the message you are trying to convey.

When typing your final version of the text be sure to use double spacing and use only one side of the paper. Paragraphs should be separated by at least three spaces. Leave wide margins all around—about two inches on top and at least an inch and a half on the other three sides. This will allow the editor sufficient room to make notations and changes directly on your copy. Number each page and put your name and address in the upper right-hand corner. When you are finished, make up a title page. This consists of a first page bearing nothing but the title of the article, your name, a one or two-sentence inkling of what the story is about, and the total number of words in the text. Don't get lazy and forget that *total*, and space the wording on the page so it is reasonably attractive. The more work you can save the editor, the more favorable his response to your article is apt to be.

Although some types of writing, such as this one, can get along very nicely without photographs, in constructional and descriptive types of articles they are very important. Photographs can make or break an article. Many an excellent piece of work has been relegated to the waste paper basket because of the poor quality of the photographs. Some types of photos, such as an outdoor shot of an antenna, can be achieved quite satisfactorily by an amateur photographer. However, for fine detail jobs, such as the underside view of a chassis, it is best to have the work done by an industrial photographer specializing in this sort of thing. They will retouch the pictures for you, masking out blemishes and highlighting fine detail with the result that you get a really excellent photograph. Do not write on the backs of photographs; use gummed labels for your captions. Your name and address should also be included.

If your article is of the type that describes apparatus or equipment of a commercial nature, don't overlook the

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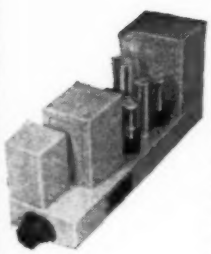

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3. Measured response (1 KC = 0).

8 Watts	½ db	40 cps. Flat @	20 KC.
20db Down	¼ db	18 cps. Flat @	20 KC.
40db Down	½ db	20 cps. Flat @	20 KC.

4. Input for full power output-Zero VU.
5. Max. Noise Level—77db below full output.
6. Gain Control Range—35 db.
7. Distortion measurement at 8 Watts: Av. tubes, 1%; picked tubes, .76%.
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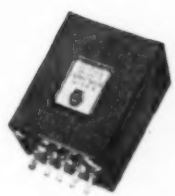

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possibility of securing your photographs from the manufacturer. Most manufacturers are glad to cooperate in this respect because of the free publicity they receive.

Liberal use should be made of diagrams and sketches if your writing requires them. Although the point you are trying to bring out might be quite clear to you, remember that the reader is not a mind reader. Anything that requires further clarification should be illustrated by photograph, sketch, or both. It is a good idea to have someone read over your manuscript to see whether everything is understandable to them. Diagrams, of course, should have all components clearly numbered, followed by a list of the parts, the "Parts List." Diagrams and sketches may be made in pencil as they will have to be redrawn by the staff artist. A transparent drawing ruler will come in very handy for this purpose. Get the kind shaped like a triangle with circular cutouts. They are swell for tube symbols, etc.

After you have gone over the completed article several times and are satisfied that it is as nearly perfect as you can make it, you are now ready to submit it for publication. Now, I bet you were going to fold up those nice typewritten sheets and put them in an ordinary envelope for mailing. Don't do it! In editorial work, everything must be kept flat. Put your sheets in a large brown envelope with stiff cardboard on both sides to prevent bending. If photographs are included, use an envelope of sufficient size to include the whole works. A couple of pieces of "Scotch" tape around the outer edges of the cardboard will hold everything intact. Gummed address stickers are very convenient to use on these envelopes. They may be obtained for a few cents at any stationery store. If you want to have your material back in the event of a reject, include a self-addressed envelope with sufficient postage.

Be sure to send everything by first class mail. Good luck to you!

Editors note: Not all publications pay for manuscripts accepted, especially those affiliated with societies or fraternal organizations. The publishers of RADIO AND TELEVISION NEWS, *however, pay upon acceptance for all material of a non-publicity character at better than average rates.*

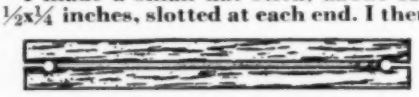
—30—

PAGE FINDER

By MELVIN W. DOAN

WHEN working on a radio bench with a paper-bound book, it is always a problem to me to keep the book opened to the proper page, or read the book after the transformers, etc. which were put on the book to keep it open were in place.

I made a small flat stick, about 12x ½x¼ inches, slotted at each end. I then



inserted a stout rubber band across the stick. By slipping the book under the band the pages can be read easily. Pages can be turned by raising the rubber band slightly. —30—

Auto Radio Static

(*Continued from page* 39)

Usually tire noise will be eliminated by a slight application of the brakes while driving, allowing the static electricity to pass off the wheels to the frame of the car. Wheel noise will change with the weather and road surface, being most persistent in dry weather and on hard-surfaced roads. Most wheel noise is caused from static electricity built up on the front tires by friction with the road surface and continuously discharging. The remedy is simply to provide a good ground path for the static discharge. The front wheels are not attached to the axle, but run on bearings which are greased, thereby providing an extremely poor ground at times. A coil spring inserted between the axle end and the hub cap will provide a constant ground and eliminate any discharge.

Since the rear wheels are usually well-grounded to the rear axle and drive shaft, static troubles here are infrequent. Need for noise suppressors here may be checked by disengaging the clutch while on the highway. If the noise increases, spring static grounds should be installed on the rear wheels also. While testing for tire noise, have the radio tuned between stations and the volume full on for maximum sensitivity.

Wheel noise may be further identified by kicking the car out of gear while driving and shutting off the engine. If the noise is caused by wheel static it will be heard continuously in the speaker. Antennas which mount under the car tend to pick up tire noise more easily than those which mount on the side or top of the body.

Tire noise may be further reduced by grounding the tire to the rim of the wheel by driving a round-head wood screw into the bead to make contact between the bead wire and the wheel rim. A conductive powder, now on the market, will also be found helpful in keeping down tire noise. Dust it inside the tire and on the inner tube before assembly.

Miscellaneous. On some installations it will be necessary to install condensers across the oil pressure gauge, ignition switch (at the battery terminal), starter switch, starter motor and possibly other electrical parts.

Not all of these anti-static precautions will be necessary on each individual automobile; however, it is difficult to say just what steps will be necessary in any individual case. Cars of the same year and model will often react in the same way, and a quick inspection of the radio installation in a car similar to yours may be of help in running down the source of interference.

When properly installed, a modern car radio should give as clear and noise-free reception as the set in your living-room. —30—

LETTERS from our readers

BETTER TELEVISION PROMOTION!

"IN regard to your article on TV promotion in the January issue of RADIO & TELEVISION NEWS, there is one important point that was not brought out, namely, the *sound*.

"In Los Angeles, and I believe in other parts of the country, a radio shop, or furniture store will have a very nice, expensive, well-engineered television set in the window, correctly operating; but it is behind the glass window of the store itself, so that the speaker, or speakers of the set that have been matched to the unit cannot be heard by the crowd outside. In place of the correct speaker system, they will have probably a 4, 5, or 6-inch speaker in a metal case stuck on the wall outside the window, and this in most cases is so badly mismatched, all you can hear is 'very poor audio.'

"Good audio, along with a clear picture are two of the best selling points that television has. I believe that poor audio has been one of the biggest setbacks that television promotion has to overcome. This not a gripe, but just a hint for better TV promotion."

A. N. Swiggett
897 West Vernon Avenue
Los Angeles 37, California

A good suggestion that will undoubtedly be seriously considered by many dealers.

* * *

BRITISH "CLAM UP" ON SCHEMATICS

"I FEEL that I must write and let you know how much I enjoy reading my one and only copy of RADIO NEWS, dated January 1947.

"I've searched our bookstalls for other copies, but apparently I'm always too late, or just unfortunate; they're just unprocurable.

"The bold manner in which you publish the manufacturers' technical circuits simply stuns me, because our radio manufacturers are like clams with their circuits, nor have we a radio magazine anything like your RADIO NEWS.

"During the war, I had the great pleasure of working with the U. S. Signal Corps in Northern Ireland, South England, France, and Burma—a fine bunch of fellows I'll probably never meet again; they were the absolute tops on their jobs.

"Should this meet the eye of any of those fellows who spent a few months in Lisburn, N. I., teaching us their speedy and snappy methods of communication, I shall certainly be glad to hear from them. They taught the 55th Signals something, believe you me. Such pleasant memories, although the days were hard, are too difficult to forget. Well, here's hoping I catch up to another RADIO NEWS. More power to your elbow!"

Ernest Chadwick
(Ex/Sgt. Sig. Corps)
26 Smollett St.
Bootle, Liverpool 20, England

It is indeed gratifying to find appreciation of this sort, but it is regrettable that it must flourish in the midst of such scarcity.

* * *

NEWS FROM THE NORTH WOODS

"I HAVE just received the February issue of your magazine and enjoy it very much. Each issue is looked forward to with so much enthusiasm that it has become an event of importance each month.

"It is in regard to the contest for amateur radio you are sponsoring that I am writing this letter. This contest is open only to licensed hams who already have the necessary equipment, and who, for the most part, are residing in thickly populated areas. The publishers, unfortunately, like all others who are promoting amateur radio, have given no thought to the large numbers of would-be amateurs who, like myself, live in the remote and unsettled wilds of our North American continent.

"Do you not agree that the furtherance of amateur radio would be serving at its best in these remote districts and thereby provide a complete unbroken link in the country, rather than continue to have them congregate in groups in the larger centers?

"There are numerous draw-backs to the prospective amateur in places like mine (there are thousands of them). The main one is a lack of electrical power. Battery power is, for the most part, out of the question, due to the need for recharging, and the long distances to the nearest facilities for this. The expense of lighting plants and radio equipment is another. It is not easy to purchase any article when every penny must be seriously accounted for.

"I do not want you to take this letter as criticism, as it is intended merely to bring to your attention a class of people who are always barred by circumstances from most events of importance.

"I am very interested in radio and have been planning an amateur station in this district for some time now, but am held back by the same circumstances listed above.

"The town of Quesnel, where I live, is located in the northern part of British Columbia and is now gripped in the middle of a severe winter. I live

some distance from this town, but just the same, I went in expressly to get the current issue of RADIO & TELEVISION NEWS. I might add that it was 32 degrees below zero. I wonder if any of your large city hams would walk 14 miles in like weather for their copies?

"Thanking you for a good magazine." . . . . . J.H.S.

Fourteen miles in 32 degrees sub-zero temperature for a copy of RADIO & TELEVISION NEWS. *That is a record! It's obvious that lots of our big city hams do not realize the little effort* they *expend in keeping up their hobby.*

* * *

HERE'S A LIKELY RECRUIT

"I'D like to help someone win that $1500 ham station. I'm not an amateur, but I want to *be* one, and I'm writing to you for help.

"When in the Army, I began taking the *National Radio Institute* course and had about a third of it completed when I was discharged. I cashed my war bonds for a *Hallicrafters* SX-28A and began learning code. Later I entered Purdue to study electrical engineering, but had an accident in which I broke my neck, and I've been paralyzed from the chest down since.

"I've been in the hospital since. I tried to go on with my radio, but gave up because I could no longer hold tools or equipment. Then all of a sudden, I asked myself why couldn't I go on and get my license anyway? Of course, a lot of the fun comes from building and experimenting, but I could buy a transmitter and learn the theory well enough to pass the test. I started the *NRI* course all over again and bought a *Hallicrafters* SX-42. (Now I hope I can sell the SX-28A to pay for it.)

"Well, that's my story. I probably can't take more than 6 or 8 w.p.m. now, but when I saw the contest announcement I decided to write in the hope that you could tell me how I can get a little help with my theory. No matter how many times I read them over, I still don't understand certain things.

"I'll be very glad to have somebody help me qualify for that priceless ticket, so that at the same time I could help him get some of those prizes."

Charles Apon
Ward 84, Vaughan Hospital
Hines, Illinois

Enthusiasm like this would certainly help the cause of ham radio, and there must be an interested, already established amateur able to devote some spare time to helping Charles over the hurdles.

* * *

RADIO & TELEVISION NEWS CERTAINLY GETS AROUND

"I READ your February issue of RADIO & TELEVISION NEWS with much interest. This is the first American radio magazine I have seen and read.

"While it is at the moment not possible to buy this fine magazine in Germany, I would like to ask your read-

ers if any of them would be willing to exchange their American magazines for German publications. I would also be very happy to exchange questions pertaining to all phases of radio. We could correspond in English or German.

"I do hope you can help me. I send my thanks to you, and congratulations on such a fine magazine."

Gebhard Auerswald, Engineer
282 Bahnhofstrasse
Lispenhausen b/Bebra
U. S. Zone, Germany

Here is a chance for some of you hams and radio enthusiasts to correspond with someone who really knows European radio. Undoubtedly, a lot of good would be realized by such an exchange of information. How about dropping Engineer Auerswald a line and comparing notes on your respective problems? —30—

HAM CLUB FIELD DAY

THE radio ham clubs of Arizona are sponsoring a statewide Field Day contest in which amateur stations outside of the State of Arizona and in the United States are invited to participate. A certificate of award will be presented to stations outside of Arizona submitting the highest score in their call areas.

Two points will be counted for each Arizona station contacted between 2 p.m. and 12 midnight, MST, on May 14, and 7 a.m. and 3 p.m., MST, on May 15 using either c.w. or phone. The same station may be worked for full credit on different bands, and the total score is multiplied by the number of Arizona Field Day stations worked. Arizona stations operating at home locations count two points also, but may not be used as multipliers.

To enter the contest, watch for W7 stations calling "CQ Arizona" or call "CQ Arizona." Scores should be mailed not later than June 1, 1949, to SCM Gladden Elliott, 39 North Melwood, Tucson, Arizona. —30—

HAM RADIO GOES SCIENTIFIC

DR. PAUL H. KIRKPATRICK, Stanford University x-ray expert now on sabbatical leave and spending a semester at Bowdoin College as visiting professor of physics, is making use of short-wave radio to supervise research work at Stanford on the x-ray microscope he invented.

Albert V. Baez, Stanford research assistant in physics, who is continuing the development work in Dr. Kirkpatrick's absence, speaks from amateur station W1KJU, operated by Melvin Goodwin at his home at 875 La Pera Avenue, Palo Alto. Dr. Kirkpatrick speaks from the home of Murray Litchfield, operating radio station W6WLL from a house close to the Bowdoin campus.

The hour-long, cross-country confabs are held every Monday at 2:00 p.m. (CST), or 5:00 (EST). Melvin Goodwin, who suggested the ingenious conferences, says the contacts have been very successful and that reception on the 10-meter bands has been so clear that not a word has been missed. —30—

Plate Dip Unit

(*Continued from page* 43)

in measurements, the search coil should be coupled as loosely as possible to the circuit under test.

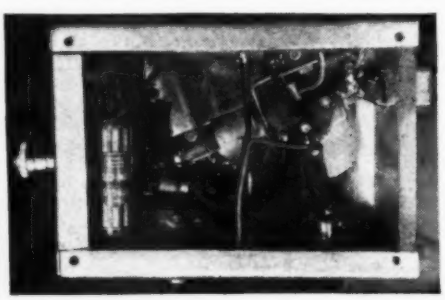
A further word about the dial. After marking the calibration points with India ink, the dial was treated with an oil coloring. The oil colors were purchased from a photograph shop in the form of a beginner's hand coloring set for about a dollar. The little kit contains 8 shades in an amount suitable for coloring literally hundreds of dials and perhaps some pictures, too. The colors are applied with a tiny wad of cotton around the end of a toothpick and no talent is required to make a very presentable dial with a different color for each band. If you are not satisfied at first, you can remove a part or the whole thing with a solution included in the kit and start over again. After several days, the whole dial can be given several coats of lacquer and the job is made permanent. To identify coils with the proper dial calibration, a dot of color is put on the inside of the coil forms. This type of coloring system is, of course, adaptable to the commercial home-calibrated dials made by *Bud, Millen,* and *National.*

To try and mention all the possible uses of an instrument such as this plate dip meter is a gargantuan task as the applications are limited only by the ingenuity of the user. However, a few of the primary functions can be here summarized: The resonant frequency of circuits can be measured or adjusted to desired range without requiring any energy in the circuit itself, hence a transmitter can be tuned without the power turned on and a trap can be similarly adjusted. Antenna resonance can be found by coupling the search coil to the end of the antenna or the feed system.

As a signal generator, set the dial to the frequency desired and align your equipment. If modulation is a must, connect a switch in the negative return of the filter condenser; this will cause the oscillator to be modulated at the supply frequency.

In the non-oscillating condition, the meter will read upward when reso-

Interior view of unit. Note short, heavy lead from tuning condenser to coil socket, and bracket mounting of tube socket on condenser. Control is "full scale-zero adjust." A penlight cell provides bucking current.



nated to an r.f. source and can be used as a sensitive field strength meter, an absorption frequency meter, a harmonic checker, a parasitic hunter, a sensitive neutralizing indicator, and, of course, a phone monitor.

Still other applications of this handy gadget can be found and once a "build-it-yourself" ham or experimenter has one, he won't part with it for love or money.

-30-

FM Booster

(*Continued from page* 41)

It was found that the use of the preamplifier resulted in a great improvement in receiver sensitivity. Stations that were barely audible in the background noise were brought up to a point where very little noise was noticed, while the total number of stations logged was more than doubled.

As a most convincing demonstration of the performance of the preamplifier, the antenna can be replaced with a 300-ohm, ½ watt carbon resistor. A certain amount of noise, which appears as a smooth, rushing sound, will be noticed at the receiver output. If the thermal energy of the resistor is increased by raising its temperature, the Johnson noise will appear as an increase in the receiver output. If a lighted match is held under the resistor for a few seconds, the noise may increase to a point where it is practically deafening. Before you build the preamplifier, make this test with the receiver alone!

Other Applications

Although the booster described was intended particularly for the FM band, it can be used on the 10, 6, and 2-meter amateur bands merely by changing L_1, L_2, L_3, and L_4. Also, with suitable coils it should perform well ahead of a television receiver. The band width is sufficient to cover two adjacent channels. In making these changes, it will be necessary to determine coils L_1, L_2, L_3, and L_4 experimentally.

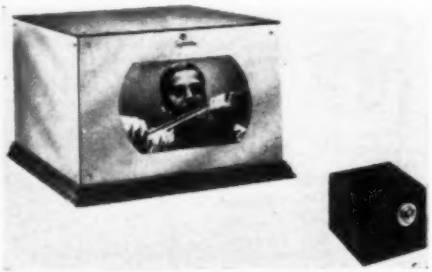
-30-

"Do you have that headachy, run-down feeling? If so . . . !"

NEW TV RECEIVERS ----------on the Market

ALL-MIRROR TV SET

The all-mirror television receiver, named the Pandora 15, produced by *Sightmaster Corp.*, 20 E. 35th St., New York, N. Y., has safety glass mirror for sides, and the exclusive feature of "Sightmirror" on the viewing side.



This 15-inch glass tube set is listed at $675.00.

The Sightmirror principle is aimed at providing an attractive front on the receiver when it is not in use. The mirror eliminates the unattractive dead space, and when the set is in use, the television picture comes through as a soft filtered picture. So that no knobs are necessary, it is tuned in by a remote control unit that can be operated from an armchair.

This new model will be distributed nation-wide through the organization sales system.

FOUR-WAY TV COMBINATION

The *Sparton* Radio-Television Division of *The Sparks-Withington Company*, Jackson, Michigan, recently introduced among its new line of television models a TV console in mahogany finish, priced at $399.95, east of the Rockies.

This new console, Model 4916, has a

ten-inch screen with 54-inch picture, automatic brightness control, 28-tube chassis, and a choice of mirror-view or direct-view screen. In common with the other models, this console has a dual-purpose, single-arm, two-speed record changer, for playing standard records at 78 r.p.m. and long playing records at 33⅓ r.p.m. automatically.

In the first of a number of showings, these combinations were unveiled to *Sparton* dealers of the Detroit area and it was hoped to bring them to all major television markets soon.

17-TUBE LOW-PRICED TV SETS

Model 807, part of the new line of table television receivers coming from *General Electric's* Electronics Park, Syracuse, N. Y., is mounted in a compact blond oak cabinet, at the list price (eastern) of $289.95. It uses a simplified circuit design, necessitating only 17 tubes and three rectifiers in addition to the 10-inch picture tube.

Three table models, 805, 806, and 807 comprise this new line, along with Model 809, a contemporary console in

mahogany finish. All of the sets, with the exception of 805, listing at $239.95, will have "Daylight" television tubes, said to produce pictures 80 per-cent brighter than other tubes operating under the same conditions.

All of these new receivers are pretuned to the 12 television broadcast channels and are equipped with the *G-E* automatic clarifier, a stabilization circuit intended to reduce the interference caused by passing automobiles or unfiltered electrical appliances.

"GUEST TELEVISION" SYSTEM

The system designed and manufactured by *Industrial Television, Inc.*, 359 Lexington Avenue, Clifton, N. J., was scheduled to be installed in the Louden-Knickerbocker Hall sanitarium in Amityville, New York, according to a recent announcement.

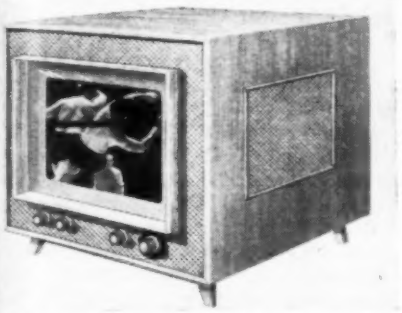
This so-called "guest television" system incorporates many features necessary in an institution of this type. All of the tuning will be done at the central control unit. The individual picture units use a 15-inch picture tube and have absolutely no operating con-

trols. Shatterproof plexiglass covers the picture tube.

The receivers are to be installed in the recreation rooms of the various sanitarium buildings with provision to expand the system to the sanitarium theater.

VIDEO LARGE-SCREEN TV

One of the new features of the *Video Corporation of America* line of low-priced receivers is the inclusion of a circuit, the "plakron compensator,"



which produces a high-fidelity picture in much the same way that a tone control increases the tonal range in a radio receiver.

One of these models, priced at $459.00, is a new 135 square inch, direct-view table receiver, scheduled for dealer delivery. Others include a 91 square inch table model at $359.00 and a 91 square inch consolette at $379.00. In addition, there is a 135 square inch console with sliding door and hidden controls that turn the receiver into a handsome furniture piece, priced at $499.00.

According to the manufacturer, *Video Corporation of America*, 229 West 28th Street, New York City, particular attention was paid to the development of these models, to make them trouble free in performance. All heat producing components that tend to deteriorate parts have been eliminated.

CROSLEY TV-AM-FM CONSOLE

The *Crosley* so-called "complete-entertainment" television - radio - phonograph consoles include the blond oak Model 9-414B, in the functional lines

and smart finish of the modern motif, at $529.95.

The new line provides *Crosley* spectator television reception with the 10-inch direct-view picture tube, both

frequency modulation and standard broadcast reception, and an automatic phonograph with two-speed player and the *Crosley* jewel-tone system. In addition, there are record library storage spaces on either side of the record playing compartment. The consoles have full-length panel doors which can be closed to put them in complete harmony with the room settings when the instruments are not in use.

The *Crosley Division, Avco Manufacturing Corporation*, 1329 Arlington St., Cincinnati 3, Ohio, will be happy to supply further information on these sets.

NEW FREED-EISEMANN TV MODELS

All of the television receivers manufactured by the *Freed Radio Corporation*, 200 Hudson Street, New York 13, N. Y., use the 16-inch metal tube. In a recent demonstration, a specially-invited group of retailers from the East saw four new consoles, which marked *Freed Radio Corporation's* entrance into the television market.

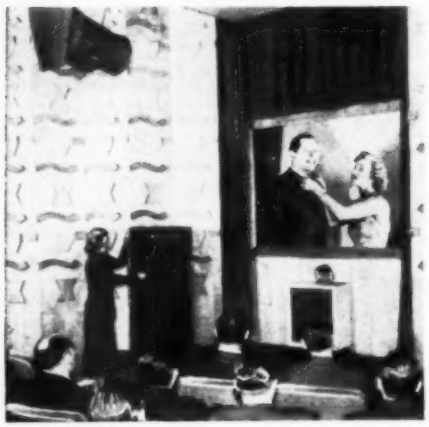
These *Freed-Eisemann* models are housed in period design cabinets with a high eye level, permitting strain-free viewing from any part of the room, without a disorderly rearrangement of furniture directly in front of the receiver.

According to Arthur Freed, president of *Freed Radio Corporation*, the company's entire engineering and production efforts would be devoted to television models with the 16-inch metal tube. The consoles are available in Sheraton, Chinese Chippendale, Regency, and Chippendale styles, and the retail prices range from $625 to $1295.

LIFE-SIZE TV

A new life-size television projection system, featuring an optical barrel which is suspended from a convenient ceiling mounting, has been announced by the *RCA* Engineering Products Department, Camden, New Jersey.

The system is especially adaptable



for use in night clubs, hospitals, taverns, clubs, hotels, industrial plant recreation, and lunch rooms. The ceiling mounting lends itself to built-in applications in harmony with a room's decorations, and the space-saving aspect of the installation is also a major feature.

The optical barrel is connected to the control console by a 40-foot cable. In use, the barrel is focused on a screen up to 6 by 8 feet in size, of either the front or rear-projection type.

The system (TLS-87) has a 30-watt amplifier, with microphone and phonograph inputs provided so that the unit can be used as a public address system when television programs are not on the air.

FIRST UST CONSOLETTE

The first 15-inch television-radio consolette to be produced by *United States Television Mfg. Corp.*, 3 West 61st Street, New York 23, N. Y., features a Zetka 15-inch glass viewing tube with a flat face to provide more picture space. The tube has an ion trap which is designed to eliminate ion stain, an eye disturber which sometimes occurs in tubes without this feature.

A full consolette, this model does not require the use of any supporting furniture, and has, besides large-screen television, FM radio reception. It is priced at $625, which the manufacturer feels is comparable to 16-inch metal-tube table models at the $500 level, since these do not have FM radio, and the consumer must have a supporting table.

A producer of television sets since

pre-war days, *United States Television Mfg. Corp.* will distribute its models on a national scale. Other *UST* models range from 10-inch table models to large-screen projection TV sets for public places.

THEATER TELEVISION

Television on a life-size 6 by 8 foot screen is a major attraction at Walter Reade's *New Majestic Theater* in Perth Amboy, New Jersey. The theater reopened recently upon the completion of a $150,000 remodeling program that included installation of the video lounge.

This special 40 by 25 foot lounge was installed as an additional patron service. There is no charge for admission to it—the patron may see both the theater's screen attraction and the television while in the theater.

The set used is the new *RCA* TLS-86, housed in a portable wheeled cabinet. From a spot 14 feet away from the center of the screen, it throws a picture 6 by 8 feet in size. It replaces a 20-inch tube television set installed nearly two years ago and at that time the largest available.

According to Walter Reade executives, the present television picture is the largest ever presented publicly in New Jersey, and the biggest direct video pictures ever unveiled for regular daily viewing.

HOFFMAN 16" COMBINATION

The *Hoffman Radio Corporation*, 3761 S. Hill St., Los Angeles, California, announces that a new combination radio-phonograph and television receiver has been released, which features the new 16" metal tube.

In cabinet style, the set, Model 902, is a twin of the company's Model 900, but the new combination's 16" metal tube presents a particularly clear,

crisp, and bright image to the viewer, according to the manufacturer. This is especially true when used in conjunction with the Easy-Vision Lens.

Other features of the Model 902 include a 12" acoustically treated speaker, plus such regular *Hoffman* TV features as an automatic picture synchronizer which locks the picture in focus electrically. It is housed in a blond oak cabinet, 37 by 40 by 21 inches.

-30-

TV Antenna Compass

(*Continued from page* 69)

should be temporarily disabled during any measurements. This is easily done by following the directions of the manufacturer for service or alignment of the video channel. Since such a receiver having a.g.c. would automatically attempt to adjust its gain to compensate for a weaker or stronger signal, *any* antenna adjustments, with or without the use of the *Simpson* antenna compass, to be at all informing, would have to be done with such a.g.c. disabled.

One of the first questions to come to the mind of the reader is—"How can it possibly show ghosts?" Well, it will, *provided the ghost is of the type about which anything can be done by orientation or location of the antenna.* It is not generally realized that there are actually at least *three* types of ghosts (displaced images) which appear on the TV screen. While a thorough discussion of this subject is beyond the scope of this article, the problem may briefly be stated as follows.

First, there is the ghost due to mismatch of the impedance of the antenna, the transmission line, and/or the receiver input circuit. The reflections, due to this mismatch, coursing back and forth along the transmission line, cause a slight time delay in the impulses supplied to the picture tube. With any reasonable length of line, and not *too* bad a mismatch, this time delay is usually so slight that actual multiple images do not appear, but a general loss of horizontal definition may result, giving the effect of poor focus and a lack of crispness to the image. Obviously, no change in orientation of the antenna will cure this; the solution lies in a good match. This is by no means an easy job when all-channel operation is considered. There is a lot of room for development work on TV receiving antennas.

The second type of ghost originates *near the transmitting station.* Reflections which are caused by objects located relatively near the transmitter arrive at the receiving site from nearly the same *direction* as that of the prime wave, but delayed in *time.* This time delay causes the displaced image. Now, with any practical receiving antenna, the horizontal directivity is so broad that the antenna is unable to discriminate between waves arriving from directions displaced by only a few degrees. Again, obviously, no practical change in location or orientation of the receiving antenna can cure this trouble. This is a real problem, and it does not appear that it can be solved at the receiving site but is rather one for the transmitter engineers. The selective removal of a few large office buildings would undoubtedly help matters, but appears a bit impractical.

The third type of ghost, (and this is the one that we *can* do something about), originates from reflections relatively near the receiver and sufficiently off-axis from the prime wave so that the acceptance pattern of the receiving antenna can discriminate against it. Fig. 1D shows how this time delay due to longer path, and directional difference due to reflector location, originates. Now, assuming that the source of such a reflection is displaced at least twenty degrees or so from the path of the direct wave, we can, by rotating the antenna somewhat to the opposite side of the peak, reduce the ghost to negligible proportions without reducing the prime wave too greatly. Such adjustments must always be a compromise between allowable diminution of the prime wave in relation to the strength and direction of the ghost.

Now, if we know the direction from whence the ghost arrives, we can much more rapidly and intelligently discriminate against it. It is gratifying to see how well the use of the meter shows up this direction, and, therefore, the direction to which the antenna should be turned to nullify it. By slowly rotating the antenna while watching the meter pointer, if no directionally displaced ghosts are present, the curve will be a smooth one, rising to a peak and falling off uniformly on the opposite side. This, of course, assumes that the antenna itself has a smooth acceptance pattern. Now, as shown in Fig. 1C, if the movement of the pointer is non-uniform, falling off more slowly on one side of the peak than on the other, or actually showing a smaller sub-peak, off-axis reflection is present, and the remedy is obvious. Simply rotate the antenna to the side of the peak away from the ghost direction, and you have done all that the present state of the art permits.

The design of this instrument is the outgrowth of a good deal of antenna measurement work done by the writer during the past few months. The comparison of various types of indoor and outdoor TV antennas here in Des Plaines, about twenty miles from our group of four Chicago TV stations, necessitated the use of some sort of indicating instrument. While the setting up of a signal generator and a simple field-strength indicator would be obvious, it seemed simpler (and cheaper) to use the TV transmitters as the generators and the TV receiver itself as the amplifier. There are many places in the receiver circuit where an indicating instrument could be connected for comparative purposes, such as a VTVM across the video channel or a milliammeter/microammeter in series with the video diode load or the a.g.c. load. All such measurements are, of course, merely comparative and are not quantitative, but if the gain of the amplifier (receiver) remains constant, and comparisons are made rapidly enough so that wave propagation conditions do not materially change, and if the power output and picture modulation of the trans-

mitter does not change, such comparisons are quite reliable, capable of duplication, and extremely informative.

Repeated trips from the test antenna site to the receiver site, to see what change had been effected, speedily made it obvious that if the indicator could be taken to the antenna a good many footsteps and much climbing effort could be saved. The use of a long extension cord between the probe and the meter soon made it apparent that such an indicator would be a useful tool for the TV installation man. In order to make a commercially practical instrument, however, it was necessary to find a connection location in the circuit of the TV receiver which would, first of all, be representative of the video output (and, therefore, the input); second, be universal to *all* TV receivers; and third, be easily accessible, on the job, without recourse to the wire clippers and soldering iron or the necessity of getting into the chassis wiring.

The obvious place for this is the picture tube itself, since the voltage supplied to its controlled electrode is representative of the input and all such tubes are so connected that the flexible leads are easily accessible. The special test clip with the needle-point contact makes connection to the controlled electrode easy, without insulation scraping or other nuisances.

The probe contains a resistance-capacitance network, an isolation condenser, and a crystal rectifier to actuate the meter movement. The constants of the network and the sensitivity of the meter have been chosen to disturb the video circuit as little as possible, and, generally, negligible change in picture appearance is noted with connection of the probe. For convenience, the clip may be removed from its junction box without disconnection from the picture tube lead, by a plug-in arrangement.

The meter, in conjunction with its probe, gives an indication directly proportional to the integrated r.f. voltage applied to the picture tube by the received energy from the transmitter. Since the probe contains an isolation condenser, the d.c. level of the controlled electrode makes no difference, and, therefore, the "brightness" control and other receiver controls have no effect. Only the video gain (contrast) and, of course, the tuning control affect the meter reading.

With the intelligent use of this instrument the TV installation and serviceman can now make an antenna adjustment in a truly engineering manner, eliminate a great deal of "cut-and-try," and substitute actual measurement for personal opinion and guesswork. He can leave the home of the owner of a nice, new, shiny TV receiver confident that he has done the best job possible in this particular receiving location, and in the course of time save up a good many man hours for that long fishing trip that we all dream about! —30—

MARS Station of the Month

HEADQUARTERS, Airways and Air Communications Service, a support organization of the Military Air Transport Service, station K3FMC was named "MARS Station of the Month" by Major Rawleigh H. Ralls, Chief, MARS, Air Force.

The station is too new to have a long list of accomplishments to display, but the speed with which it was put on the air, its traffic handling activities, and its consistency of operation are indicative that the NCS for Headquarters AACS will merit this recognition in its continued operation.

Master Sergeant Arthur R. "Mac" McKinnis, W4QOC, as chief op, puts in a full day pounding brass with an occasional break to put through a 10-meter schedule to DL4 or W5 land for a personal QSO for some member of MATS staff or their families.

C.w. operation occupies 99 per-cent of the time and the ultimate ambition is to be the lead station in the "Brass Pounders League" every month. At the moment K3FMC has entered the Eastern Shuttle Net on 7120 kc. at 1030 every morning. In addition to making deliveries in the Washington, D. C., area, Mac has a message box at Headquarters building, and this is generating a bit of traffic.

Organization of world-wide nets covering the far-flung outposts of Airways and Air Communications Systems is waiting only on the clarification of call signs for MARS stations outside the ZI.

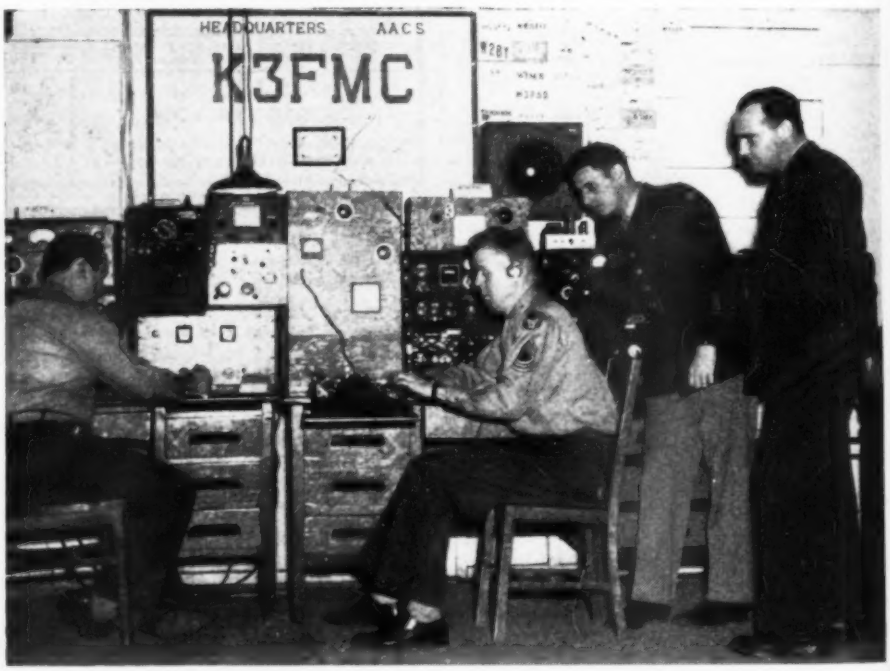
The station layout consists of an HT-4 (ancient vintage BC 610), a BC 610-E, and a home-grown peanut whistle for 40-meter operation exclusively. The HT-4 has been modified for 10-meters and is v.f.o. through the courtesy of T/Sgt. Leonard Finkle, ex-KL7FY, who built it out of surplus Navy gear. The 610-E is used for 20 and 80-meter operation in most part and is resorted to on 40 meters only when things are especially rough.

The pet transmitter is the one that Mac put together in the fall of 1945 using a BC 375 and one of its tuning units for chassis and cabinet. The v.f.o. uses a 6G6G oscillator and a 6V6 isolation stage. A VR-150 is used for voltage regulation. The transmitter proper uses a 6V6 doubler, a 6V6 buffer, which is keyed in the cathode, into an 807 with about 60 watts input. Mac feels the same way about shooting squirrels with a shotgun that he does about using more than 100 watts on 40-meter c.w.

The receiver complement consists of two SX 28s, two Super-Pros, a BC 342 and an Echophone.

Antennas really sprout from the shack. A 3-element close spaced,

Lt. James B. Bartlett (K3FMC), trustee, and Lt. (j.g.) Richard F. Thorpe observing message handling at K3FMC. L. to R.: M/Sgt. Alois M. Palenchar (W40WG) shown completing radio telephone contact; M/Sgt. Arthur R. McKinnis (W4QOC) copying traffic from W2MRL; Lts. Bartlett and Thorpe. Sgt. McKinnis is a non-commissioned officer in charge of K3FMC, Airways and Air Communications Service's amateur radio station.



which is rotated by hand, is fed with a 600-ohm open wire line and is delta matched into the driven element because the owner of same did not want it cut in two. There is a 10-meter and 20-meter doublet, each fed with coax, an end fed 40-meter full wave, and a center fed Zepp cut for 80 meters that works well on all bands.

Unification of the services is exemplified in the operation of K3FMC with Lt. (j.g.) Richard F. Thorpe, W3PHB, at the key or on the horn, evenings and week ends. Lt. Thorpe is an instrument flying instructor at Anacostia Naval Air Station during the day.

Master Sergeant Alois Palenchar, W4OWG, as second op, spends as much time as his duties will permit, sometimes indulging in two-band operation or giving the first op a break. His ear is always cocked for VK2's since his XYL hails from Melbourne.

Lt. James B. Bartlett is station trustee for K3FMC and has also been appointed as MARS director for Headquarters, Airways and Air Communications Service.

The majority of the 200 odd QSO's per month are traffic handling or rag chews with DX holding only a small allure. The Gang at K3FMC say QRU? and are always happy to QSP.

—30—

EUROPEAN TELEVISION FACILITIES

A RECENT London news item reports that only one country on the Continent (excluding Britain) can boast of television service at present. France is operating a 425 line transmission from the Eiffel Tower in Paris, and two additional French stations, operating with 819 lines, are being proposed. It will be a year or more before these are ready, however, and for the time being, no other Continental country has ordered any TV transmitting equipment, nor have any of them decided on the number of lines they will use. . . . . K.B.

ANNUAL S. T. E. N. CONVENTION

THE ANNUAL convention of the South Texas Emergency Net, largest emergency net in the world, will be held in Cuero, Texas, again this year, May 28 and 29. This is a real hamfest with emphasis on emergency and net operation. Attendance last year numbered between 400 and 500, and all OM's, XYL's, and others interested are invited to this year's celebration.

On both days, there will be entertainment as well as technical information, interspersed with lively contests and prize drawings. On Saturday, May 28, there will be a special mobile contest on the way to the convention, beginning at 7:00 a.m., in which as many stations as possible will be worked.

Besides the regular program, it has been arranged to have the FCC inspector present, and those who want to take their amateur license exams may do so on Saturday.

Contact B. B. Thorn, W5CIX, Cuero, Texas, for information, or tickets to the convention, which are $2.50 each.

—30—

International Short-Wave

(*Continued from page* 58)

According to Nattugglan, Sweden, reports to Karachi should be addressed to Z. A. Bokhart, Esq., Controller of Broadcasting, *Radio Pakistan*, Mohammed Ali Jinnah Road, Karachi, Pakistan. The Swedish publication reports the 6.070 outlet is heard in Sweden 2130-2210, with news at start.

Radio Australia reports that the Dacca station is eager to receive reception reports, especially from distant points, and that the QRA is simply *Radio Pakistan*, Dacca, East Bengal, Pakistan.

Finally, here are a few brief background notes on Pakistan that may add to your enjoyment of its radio broadcasts:

The new Dominion of Pakistan comprises two zones a thousand miles apart, embracing portions of a number of predominantly Moslem provinces in the northwest and northeast corners of India and a number of Princely (native) States. The zones are connected by sea, air, and radiotelephone links. The area is approximately 361,000 square miles, and the population is upwards of 70 million. Pakistan consists of four provinces—East Bengal, capital Dacca; North West Frontier province, capital Peshawar; West Punjab, capital Lahore; and Sind, capital Karachi.

Karachi, the nation's capital, is a seaport and is an important airline junction as well, having the largest airport in all Asia. It is the seat of the Sind University.

The national flag of Pakistan is green and white; the white portion, which is one quarter of the flag, stands for the non-Moslem minorities; on the green part appears a white crescent and heraldic star.

As you probably know, Pakistan is essentially agricultural, chief crops being jute, cotton, wheat, and rice; in fact, the Dominion is the largest producer of jute fiber in the world. Tea and oil seeds are exported in quantity. A geological survey—now under way—has already revealed the existence of rich deposits of oil, coal, sulphur, salt, lime, chromite, asbestos, antimony, steatite, and gypsum.

Eastern Bengal was over-run by the Moslems at the end of the 12th century. It is a land of rivers, tributaries of the Ganges and the Brahmaputra. These serve as highways, and bring down the alluvial soil which makes it one of the most fertile countries in the world. It has a good seaport in Chittagong. Its products include tea, indigo, jute, timber, and many kinds of grain.

Pakistan was accepted as the 57th member of the *United Nations* on September 30, 1947.

As we take our leave of radio in the new Dominion of Pakistan, it is with a feeling that already the Dominion is

well under way with its program for providing radio facilities—both for domestic and foreign consumption. Our hearty congratulations and best wishes for the future go this month to *Radio Pakistan!*

* * *

Verification Data

QRA for Tashkent is Radio Taschkent Broadcasting Commity, Taschkent, USSR. (Nattugglan, Sweden)

COCQ may be addressed in care of CMQ Network, Inc., Radio Center, Havana, Cuba. (Bachman, Pa.)

Here are a few current QRA's from Sidney Pearce, England—Foreign Broadcast Section, Radio Indonesia, Koningsplein Zuid 17, Batavia C., Java, D.E.I.; Forces Broadcasting Station, Station Commander, No. 4, Cyprus M.E.L.F. 3; JJOY, Grecian District, Office of the District Engineer, Corps of Engineers, Athens, Greece; VUM, Station Director, No. 15, Marshall Road, Egmore, Madras, India; Emissora Nacional, Rua do Quelhas, Lisbon, Portugal.

Radio Hong Kong, Hong Kong Broadcasting Studios, Hong Kong, has written Gaynor, Calif., thanking him for his reception report; stated "It was very welcome, as we don't often get a report from America. I'm afraid that we don't send out verification cards—we are a Government department, and the expenditure has not yet been approved. However, we enclose a schedule of our times of transmission, etc." The letter was signed by D. Keith Hardy, Program Secretary.

Address for XGT-2 series is Chinese Govt. Radio Admin., Sasson House, Tienchil Road, Shanghai, China. (Gaynor, Calif.)

* * *

Club Notes

Sweden—Nattugglan, "Night Owl," house organ of the Scandinavian DX-Club, is available to overseas club members for 20 IRC's for a whole year, 10 IRC's for a half year; QRA is Box 563, Jonkoping 2, Sweden. President of this fine organization is Karl-Ake Bergstrom; editor of *Nattugglan* is Viggo Bengtsson.

United States—Walt Morgan, Pa., informs me that the World-Wide DX Society has merged with the Dial Spinner's Club under the latter's name. Publishes a monthly bulletin.

* * *

This Month's Schedules

(*NOTE:* Some stations are now changing to Summer Time, in which cases schedules may be *one hour earlier* than listed herein.—K.R.B.)

Albania—Nattugglan, Sweden, lists Scutari on 8.220 at 2330-0100, 1300-1630, says at 1300-1400 has own program, but after 1400 relays ZAA, Tirana. It lists *Radio Korce* on 6.280 with weekday schedule of 0045-0200, 0530-1200, and Sundays 0630-0715, 1145-1505.

ZAA, 7.852, Tirana, heard in Newfoundland 1500-1630; *English* 1515-1530. (Peddle)

Algeria—Radio Algiers, 9.570, heard well lately in Arabic before 1445-1530 and French from 1530 to sign-off 1800.

(Hagen, Ala.) Heard testing on 11.836 at 1145-1230. (Swedish DX)

Anglo-Egyptian Sudan—Omdurman is still heard on approximately 9.750 during Arabic session 1400-1430; call of *"Huna Omdurman"* is clear and distinct. (Pearce, England) Other British listeners report this channel audible in England 1130-1300, 1400-1430. Only *English* is Fridays 1230-1300. (Swedish DX)

Angola—CR6RL, 8.090, Luanda, heard 1330-1600 sign-off, same for CR6RA, 9.470. (Peddle, Newfoundland)

Argentina—LRS, 9.315, Buenos Aires, heard 1730-2100; LRU, 15.290, heard 1515-1600. (Peddle, Newfoundland) LRY-1, 9.545, heard 0515 with Spanish news. (Alfred, Ontario)

Australia—Recent schedule alterations of *Radio Australia* effected these current listings—at 0900-0945, VLA6, 15.200, to N. Asia, British Isles and Europe, while VLC11, 15.21, is used to S. Asia, British Isles and Europe; 0900-1000, VLB3, 11.76, to S. Asia, British Isles and Europe, and same time, VLG3, 11.71, to same areas. At 1000-1115, VLA6, 15.20, to North America (West Coast), VLC3, 11.76, to same area, VLG3, 11.71, to S. Asia; at 1015-1115, VLB9, 9.615, to Africa. At 1500-1655, VLC (dependent on BBC monitoring report for clear channel, may be one of 15.16, 15.21, or 15.22), to British Isles and Europe; 1710-1815, VLC9, 17.84, to South America; other schedules remain as previously listed. (Hutchins)

Graham Hutchins, DX Editor of *Radio Australia,* has airmailed me *complete* current schedules of the Inland Short-Wave Service of the Australian Broadcasting Commission. *Melbourne*—VLG6, 15.23, Sunday through Friday 1500-1700, Saturday 1545-1700; VLR2, 6.15, Sunday through Friday 1500-1715, Saturday 1545-1715, Monday through Friday 0345-0830, Saturday 0345-0900, and Sunday 0230-0830; VLR, 9.54, Sunday through Friday 1730-0330 (next day), and Saturday 1730-0215 (next day); VLH4, 11.88, Sunday through Friday 1500-1815, Saturday 1545-1815; VLH5, 15.23, daily 1830-0315 (next day); VLH3, 9.58, Sunday through Friday 0328-0830, Saturday 0328-0900. *Sydney*—VLI2, 6.09, Sunday through Friday 1500-1745, Saturday 1545-1730, Sunday through Friday 0330-0830, Saturday 0330-0900; VLI3, 9.50, Sunday through Friday 1800-0315 (next day), and Saturday 1745-0315 (next day). *Brisbane*—VLQ3, 9.66, Sunday through Thursday 1500-0830 (next day), Friday 1500-0900 (next day), and Saturday 1545-0830 (next day). *Perth*—VLW3, 11.83, daily 1930-0300 (next day); VLW5, 9.61, Sunday through Friday 1700-2115, Saturday 1745-2115, and Sunday through Friday 0515-1030, Saturdays 0515-1100.

Port Moresby (Br. New Guinea)—VLT5, 7.28, Sunday through Thursday 1545-1900, Friday 1545-1730, Saturday 1645-2000, Monday through Friday 0315-0730, Saturday 0315-0800, Sunday 0315-0700; VLT7, 9.52, Sunday through Friday 2100-2300, Saturday 2100-0300 (next day), Monday through Friday 0030-0300, and Sunday 0100-0300.

VLI3, 9.50, Sydney, N.S.W., heard in California after XEWW, Mexico City, leaves this channel 0100; is best 0230. (Balbi)

(*Continued on page* 159)

LEAD-IN FASTENING TO TELEVISION ANTENNA

By MATTHEW MANDL

THE place where the twin-lead or coaxial cable fastens to the terminal posts of the antenna should never be the means of support for the weight of the transmission line. When the line is not pulled tight, the combined weight of the lead-in and the constant flexing the connection receives during windy days, will break the connection.

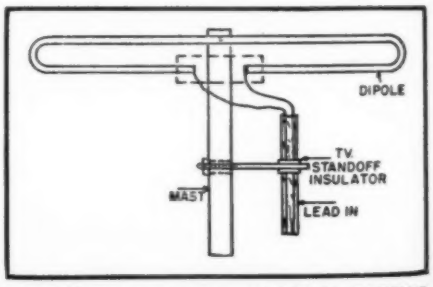
Even if it is desired to run the lead-in well away from the supporting mast in order to minimize losses, an extra fastening should be made eight or ten inches below the antenna to support the lead-in weight and prevent flexing of the lead-in at the terminal joints. This may be accomplished by use of the metal stand-off insulator with the polystyrene insert as shown in Fig. 1.

A hole is drilled through the supporting mast so that the insulator can be bolted on. If the insulator end is of the wood screw type, a slightly smaller drill can be used so that the insulator will partially make its own thread as it is turned into place. With the twin-lead type, a pair of pliers can be used to press the loop tightly around the insert. This forces the slot closed and holds the twin-lead rigidly. A thin hole can also be punched exactly in the center of the twin-lead insulation, one above the stand-off insulator, and one below. Thin string can then be pulled through the holes and tied around the insulator to prevent movement of the twin lead through the slot.

With the coaxial-type line, a stand-off insulator made for the coaxial is used. Two pieces of size 14 wire are looped around the coaxial above and below the insulator, and twisted tightly so that the line cannot shift down and exert a strain on the terminals at the antenna. Inasmuch as the outer conductor of the coaxial is at ground potential and covered with insulation, the twisted wire around it will not alter its characteristics.

—30—

Fig. 1.



10.7 mc. Discriminator

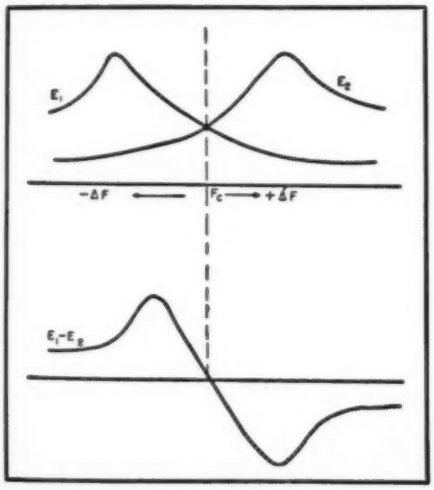
(*Continued from page* 59)

across the resistors R_1 and R_2 and thus produce a voltage difference across "*a*"-"*c*." This is illustrated in Fig. 3, which shows how the magnitudes of the resultant voltages vary with deviations in the applied signal frequency from the center frequency, F_c. The difference voltage, E_1-E_2, is also shown in Fig. 3 and gives the net potential developed across the output of the discriminator; such a curve is known as the *discriminator characteristic.* The greater the phase shift between the two component voltages supplied to each diode, the greater will be the net output voltage. Thus frequency variations can be transformed into voltage variations which are not only proportional to the frequency deviation, but which vary in polarity with the side of the center frequency to which the frequency deviation occurs. The result is an audio signal conforming to the modulating voltage applied to the carrier frequency.

The proper functioning of the discriminator circuit depends chiefly upon the linearity of the load resistors R_5 and R_6, similar diodes, and a well designed discriminator transformer. The first two requirements are easily met, and suggestions for building the third are given in the following specifications.

Fig. 1 shows the essential parts and the completed assembly of the easily built transformer. The type of coil form and shield-can shown are desirable but not absolutely essential; any adaptation of discarded i.f. transformer forms may be employed as long as the coil diameter and spacings as shown in Fig. 4 are closely followed. Also, the metallic shield should be of a size to permit at least the width of one coil diameter between the windings and the shield, both at the sides and the ends of the coils. Since the symmetrical placement of the secondary winding with respect to the primary winding prevents the use of inductive tuning, capacitive tuning is

Fig. 3. Derivation of discriminator characteristic as referred to in text.



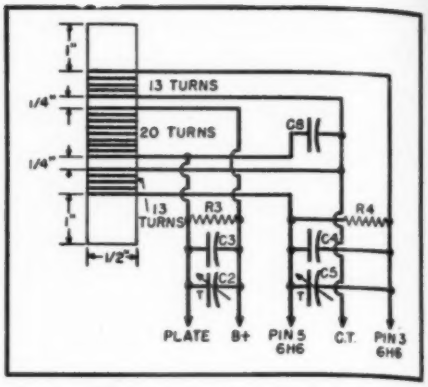
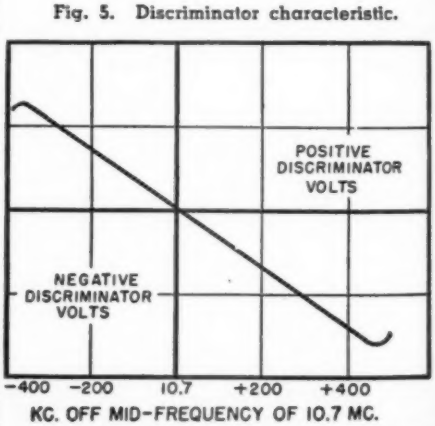


Fig. 4. Winding specifications and wiring details of the discriminator transformer.

used. Since it is desirable to use variable air condensers for better stability, this requirement limits the tuning range since it is also well to make these tuning condensers as small as is physically possible so that they can be made an integral part of the discriminator transformer assembly. However, the condensers used in this transformer, though small physically and capacitively, have ample tuning range to adjust the resonant conditions of the transformer properly.

The winding data is given in Fig. 4. The primary winding consists of 20 turns of #29 double nylon covered copper wire (#29 D.C.C. may be used as well) close wound. The secondary consists of two windings of 13 turns of #29 D.N.C. close wound, one winding being displaced ¼ inch above and the other displaced ¼ inch below the secondary winding. All windings are wound in the same direction, with the common center tap ends of the secondary winding placed closest to the primary winding. The fixed capacitance of the primary circuit is 30 $\mu\mu$fd.; while that of the secondary circuit is 40 $\mu\mu$fd. Midget micamolds were used to conserve space. The variable tuning condensers are *Underwood* silver-plated 1-5 $\mu\mu$fd. variable air condensers, that of the primary being placed at the bottom of the transformer form and that of the secondary at the top of the form. The windings are held in place by applying a thin coat of liquid polystyrene coil dope. The 10,000 ohm damping resistors and the 50 $\mu\mu$fd.

Fig. 5. Discriminator characteristic.



coupling condenser are mounted within the transformer shield.

The frequency discriminator characteristic curve is shown in Fig. 5. The data for such a curve may be obtained by means of an unmodulated variable frequency oscillator, a vacuum tube voltmeter and a discriminator circuit as shown in Fig. 1. The data for the characteristic shown in Fig. 5 was actually obtained by using a Model 900 Vomax and a surplus Signal Corps signal generator I-222-A. Using such equipment with an input of 0.05 volts the maximum discriminator output voltage was about ± one volt. In order to have a correctly operating discriminator, the characteristic curve shown in Fig. 5 should be obtained. The i.f. frequency of 10.7 mc. should be applied to the grid of the last limiter stage and the output of the discriminator measured across the diode load resistors (points "*a*"-"*c*" in Fig. 2) by means of a vacuum tube voltmeter. There should be a zero voltage output when the input frequency is exactly 10.7 mc. As the input frequency at constant voltage is varied positively and negatively with respect to the center frequency of 10.7 mc. the output voltage should vary linearly as shown by the characteristic in Fig. 5. If the output voltage is not zero at 10.7 mc. then the transformer secondary tuning condenser, C_5, should be adjusted until this condition is met. The linearity of the characteristic is adjusted by means of the transformer primary tuning condenser, C_2.

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DUST IN PROJECTION TELEVISION RECEIVERS

BY MATTHEW MANDL

TELEVISION receivers using the direct projection method or the modified Schmidt system, are prone to gather a considerable amount of dust on lenses and picture tube faces, with the result that brilliancy is reduced to a considerable degree. Unless the entire unit is hermetically sealed, dust will get through the various small crevices and holes in the projection system housing. The television serviceman is usually surprised when he inspects such sets after a half year's use, to find how much dust has actually accumulated within the "barrel" which houses the spherical mirror, the tube, and correcting lens.

When projection sets are serviced, a complete check should be made of all glass or mirrored surfaces involving the projection system. A successive accumulation of dust on all the components of the system all add up to produce a marked reduction in picture brilliance. The corrector lens, the reflecting mirror, the face of the projection tube, the viewing screen, or any other part that has to do with the projected function of the picture, should be first dusted off with a soft, dry cloth so that the abrasive characteristics of the dust will not injure the highly mirrored or polished surfaces. A chamois, soaked in warm water and wrung nearly dry should then be used to clean the surfaces thoroughly.

—30—

Navy Men Open New "HAM" Station at Pearl Harbor

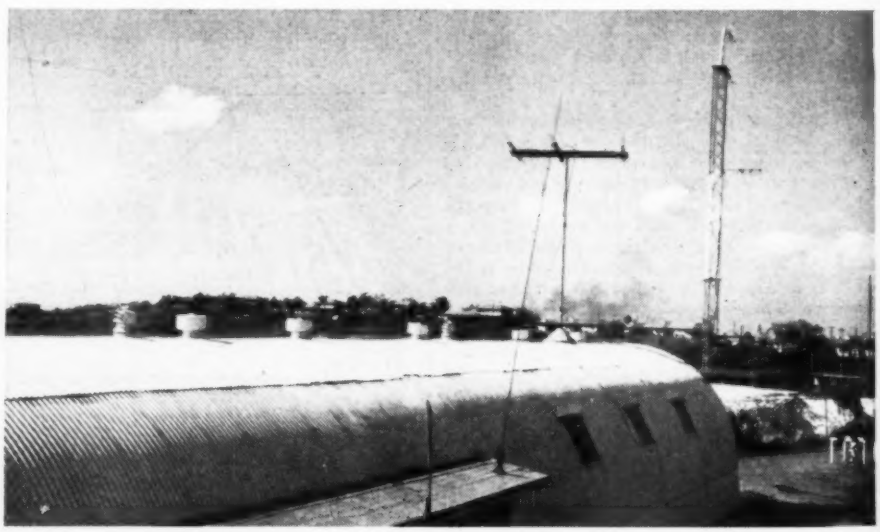
ONLY fifteen days after construction was started on the all-Navy "ham" station, KH6TX, at Pearl Harbor, it went on the air for the first time, September 30, 1948.

Under the guidance of Commander Ashton B. Jones, Jr., USN, of Sugar Creek, Mo., and James W. Armstrong, chief electronic technician, USN, of Windham, Ohio, the officers and men worked in their leisure hours to construct one of the most powerful amateur stations in the Hawaiian Islands. They gathered surplus and surveyed radio parts from sources in the Honolulu area, and utilized the highly specialized Navy course in constructing and operating this popular hobby of amateur communications.

King-How-6-Tare-Xray, operating at the legal power limit of 1000 watts, is licensed in the name of Commander Jones, fleet maintenance electronics officer. Of the men at the Maintenance Unit, four are licensed operators, including Commander Jones and Chief Armstrong. The others are studying the International Morse Code in preparation for their "ham" licenses.

Officers and men of the Fleet Electronic Maintenance Unit at Pearl Harbor. These Navy electronic specialists combined their talents and leisure hours in constructing KH6TX in less than fifteen days from non-operative parts of surplus and surveyed equipment. Commander Ashton B. Jones, Jr., USN, is shown, seated, second row.

This quonset hut is the home of King-How-6-Tare-Xray, at Pearl Harbor, one of the most powerful "ham" stations in the Hawaiian Islands. The three-element rotary beam is seen in the foreground attached to the roof of the quonset hut. The other antenna, a long wire, is shown in the background, mounted on a tripod.



Chief Armstrong reported that there is no other outfit in Hawaii more powerful than KH6TX. It tries to deliver messages anywhere in the world and to arrange radio-telephone contacts between the members of the Armed Forces in that area and their families and friends back home. One bluejacket at Pearl Harbor talks regularly with his wife in Wichita, Kansas.

The so-called "home-constructed" station was made from parts that were in non-operating condition. The Navy technicians modified some parts and repaired others in forming their station, constructing two transmitters and a three-element rotary beam antenna.

Working on the 10, 20, and 40-meter bands, KH6TX, Pearl Harbor, now carries on conversations with Japan, Australia, New Zealand, the United States, Canada, and the many "hams" in the vast Trust Territory of the Pacific Islands. -30-

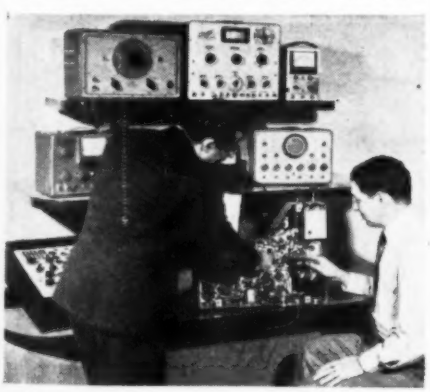
"REPS" GOPHER CHAPTER SELECTS NEW OFFICERS

THE GOPHER chapter of "The Representatives" of Radio Parts Manufacturers, in one of their recent monthly dinner pow-wows in Minneapolis, elected Jack Heimann as the new president, Fred B. Hill, vice-president, and Al Warner as secretary-treasurer.

Delegates to the "Reps" annual meeting, to be held in connection with the radio parts show in Chicago during May, were also selected. Fred Hill, a member of the Industry Relations Committee of the national group, will be delegate chairman, with Al Warner and Mel Foster supporting him. Alternates are Merril Franklin, Herb Richardson, and Marvin Kirkeby.

The Gopher group gets together in the well-known "Hucksters" room at "Harry's Cafe" in Minneapolis on the third Monday of each month to hash over mutual problems and cooperative promotion. The Gopher motor caravan "Radio Trade Tour" last Fall was so successful that a similar program is in prospect for late this year. -30-

Sun Radio's Burt Zimet, manager of the Sun's Test Equipment Center, is shown instructing a serviceman in the proper use of a new television signal generator at one of the fully-equipped test benches. The Center at 122-124 Duane St., New York, N. Y., displays all of the latest types of testing devices, and these are at the disposal of servicemen and dealers, who are urged to come in and try before they buy.



"Electric Eye"
(Continued from page 51)

remove the hum and patch up the distortion.

Well, Xavier is not in sight, so we go on to see more of his work. The electrical department is next, and there is a salesman holding a match and lifting it up to a dark electric lamp in a socket, just as though it were a candle that needed lighting. When the match reaches the lamp, it lights. Then the salesman takes down his hand and blows out the match, while the ladies near him point and seem much amused. After some talk, he reaches up again, waves his handkerchief at the lamp, and it goes out. This one is easy to figure out, because anyone can see the box right next to the lamp, with a hole in it; and of course the photorelay is right inside the box. When the match illuminated the phototube, it turned the lamp on. After that, the lamp kept illuminating the phototube, so that it stayed on. This is also just like the sign control, except that the relay contacts are connected up in the opposite way—the open side of the relay instead of the closed side. When the salesman put his handkerchief there, between the lamp and the phototube, he covered the phototube opening momentarily, and that darkened the phototube, turning off the lamp. After that, there wasn't enough light to get the lamp on again, so it stayed off. This circuit is so easy that I haven't bothered to copy it down.

Next is the drug department, and there is a big sign which says "Individually prescribed *face powder to fit your face.*" We watch the lady place her cheek to the small hole in the machine, and how the clerk turns in the first filter, takes a reading, then turns in the next filter, takes another reading, and so on. Then, the clerk compounds a special face powder with ingredients to neutralize the unwanted

Fig. 3. This photoelectric door signal circuit has a sensitivity that will surprise you. The transformer heats the cathodes of both tubes, lights the lamp, and may also be used to furnish 6 volts for a chime. You might notice that the 6V6 heater-to-cathode voltage is the full-line voltage which is more than is recommended for the tube. If that bothers you, then just use another transformer for the 6V6 but I know that it will not give you any trouble because the rating was probably set low to prevent hum pick-up in audio and radio circuits. Xavier reports he has never had any trouble with heater-to-cathode breakdowns here.

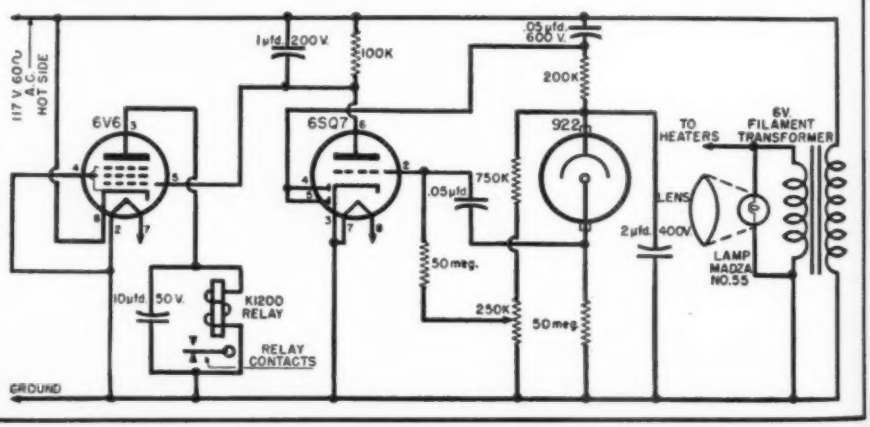
The 6SQ7 tube is used as two tubes, as a rectifier to furnish filtered d.c. for the phototube and grid circuit, and as a high gain voltage amplifier. The .05 μfd., 600 volt condenser pulls electrons from the 6SQ7 diode plates during half of each cycle, and these electrons leak back through the 750,000 ohm resistor and the 250,000 ohm sensitivity control, to make a well-filtered minus-to-ground d.c. supply, good for phototube and grid bias requirements. Of course, if you don't care about the saving of a tube, you can replace the 6SQ7 with a 6J5, and put a 1V rectifier in where the .05 μfd. condenser is in the circuit.

The high negative voltage, about 100 volts, is applied to the 922 phototube in series with a really large resistor, 50 megohms. The voltage divides more or less equally between them, according to how much light is on the phototube. A .05 μfd. condenser couples the mid-point between these two to the control grid of the triode voltage amplifier, and controls it. The second 50 megohm resistor is a grid leak and controls the grid bias of the 6SQ7. If the 6SQ7 is a gassy tube with grid current the circuit won't work, so be sure to use a good tube. Also, if the .05 μfd. coupling condenser is at all leaky, the grid will be drawn too negative. Use a new, well-waxed, low-leakage condenser and be sure not to let it get overheated from your soldering iron.

This grid circuit will let the control grid settle down to a constant bias as long as the phototube is illuminated constantly. However, if the phototube is darkened suddenly, the current through it stops, the grid gets a kick in the positive direction, and because of the high megohm resistors, this kick will last a few seconds. The plate current through the 6SQ7 rises to a high value and the 1 μfd. condenser in the plate circuit charges. This makes the control grid of the next tube, the 6V6, go more negative with respect to its own cathode, which is just right for shutting off plate current. The 6V6 had plate current because its plate is "plus" half the time. This tube operates half of each cycle, just as the 6SQ7 operates half of each cycle, but the two of them work on alternate half cycles, not together. Doing it this way saves a high voltage transformer, and has the effect of another plate supply.

Be sure to put the condenser across the relay coil in its proper polarity, with the plus side to ground, not in the usual way. A small paper tubular is entirely satisfactory and does the job of taking the buzz out of the relay. The relay contacts are normally held closed, and released when someone walks through the beam of light. If you want to reverse this, it can be done easily—just interchange the 922 phototube and its 50 megohm series resistor. Be careful not to reverse the polarity of the phototube or it won't respond at all.

This two-stage circuit is so sensitive that the 1 candlepower lamp with a 1" diameter lens in front of it can work the photocell over 20 feet away, and even if different amounts of daylight get into the photocell during the course of the day, the amplifier will not be biased improperly but will respond as it should.



shades. That is quite an idea, and the ladies seem to like it a lot, because they keep coming back for more of that expensive powder, especially the ladies that can't boast about their complexion.

This "Cosmetigraph" uses a very simple circuit, just a photocell of the self-generating kind connected to a microammeter, just as you have in your exposure meter that you use in taking pictures. The real work in it lies in the mechanical parts, getting the light to shine onto the skin without "specular" reflection effects, and collecting the light efficiently and accurately.

Now we come to the tobacco counter, really crowded and with everybody smoking away real hard. Over to the left there is a lot of coming and going, and people seem to be waiting a turn. We elbow over, and see what the attraction is—a big glass tube. That must be the smoke measuring outfit Xavier just completed, with a milliammeter to show how much smoke is in the tube. The big man presses a button, and a fan blows out the old smoke in the tube. He exhales gently into the tube, and the indicator goes way down. Now comes a thin chap with a pipe. He doesn't do as well, and there is much comment and discussion about lung size, black smoke, and light smoke. This setup is shown in Fig. 2.

Just then, Xavier himself comes along with a pencil and a pad. He is glad to see us, but we are late, and now there isn't much time. At this hour he must check over the figures on the inter-departmental counting machines which measure the volume of traffic today in the underwear department. It seems that the boss thinks this is a good way to compare the "Planet" advertising with that in the "Clarion."

So off he went, a happy, busy man. He is stouter and more prosperous looking now. Probably his clothes are made to order.

-30-

KEEP EQUIPMENT INTACT

AN ORDINARY lunch box serves as a suitable container for soldering irons of the late models, iron support, solder, tape, and other needed equipment.

The assembled outfit may be kept at the work bench where it is easily picked up for use away from the shop.

..... H. L.

Projection Television

(*Continued from page 49*)

tube neck) or away from the tube (at right angles to the tube neck). The visual effects of improper positioning of the magnets are shown in Fig. 6.

In the *RCA* and *G.E.* projection receivers the additional bar magnets are not required because the translucent screen is not slanted and because it is perpendicular to the axis of the optical system. Hence, a rectangular image on the projection tube face appears as a rectangle on the screen. The translucent screen used in these sets is composed of two lucite sheets with a partial diffusing layer between them. The back sheet has a fresnel lens molded into its rear surface. The front sheet has vertical ribs molded into its outer surface. The fresnel lens functions to concentrate the light into a narrow viewing angle. The vertical ribs act to increase the horizontal viewing angle above that obtained with a flat surface. The diffusing layer eliminates interference patterns between the fresnel lens and the vertical ribs. The screen and lens combination give a gain of approximately five over that which would be obtained from a ground glass screen.

In the *RCA* and *Philco* receivers, the projection tube, the spherical mirror, and the correcting lens are all mounted in what is known as an "optical barrel." See Fig. 9. The spherical mirror is mounted in the bottom of the optical barrel and held against a knife edge by three sets of springs. The spring pressure is strong enough to hold the mirror securely against the knife edges, but not sufficient to distort the spherical mirror.

The 5TP4 is held in a retaining ring within the optical barrel, the face of which is approximately one-half way between the correction lens and the mirror. The tube is adjusted to position by controls on the side of the optical barrel. Optical focusing is accomplished by moving the picture tube up and down vertically. Other adjustments are needed to secure proper centering of the picture tube on the optical axis of the mirror. The correction lens is held in the ring on top of the barrel and secured by three spring fingers.

Another variation of the Schmidt optical system as adopted for television is that devised by *North American Philips*. The system, known by the tradename of "Protelgram," is an adaptation of the "folded" Schmidt system and occupies only half the space of a conventional arrangement. Since the light path is folded, it is possible to mount the projection tube with its optical system within a small metal box, thereby producing a compact and dustproof arrangement. The actual metal case measures only 8½" x 8½" x 9". It contains three optical elements: (1) a 6" spherical mirror, (2) an aspherical corrector lens, and (3) a special plane mirror to "fold" the light beam. See Fig. 8. These three elements form an optical triangle within the optical unit and are adjusted at the factory. They remain in adjustment under normal use. The optical unit is dustproof, with only the upper face of the corrector lens being exposed. It can be dusted with an ordinary cloth without scratching. The light emitted from the tube face is gathered by the spherical mirror, reflected to the plane mirror and then projected upwards through the corrector lens. At the center of the plane mirror there is a hole large enough to permit the projection tube face to be inserted through it. Behind the mirror ample room is provided for the deflection and focusing coils of the tube, plus whatever tube supports are required. There is no interference from the coils and the neck of the tube, since these are behind the plane mirror.

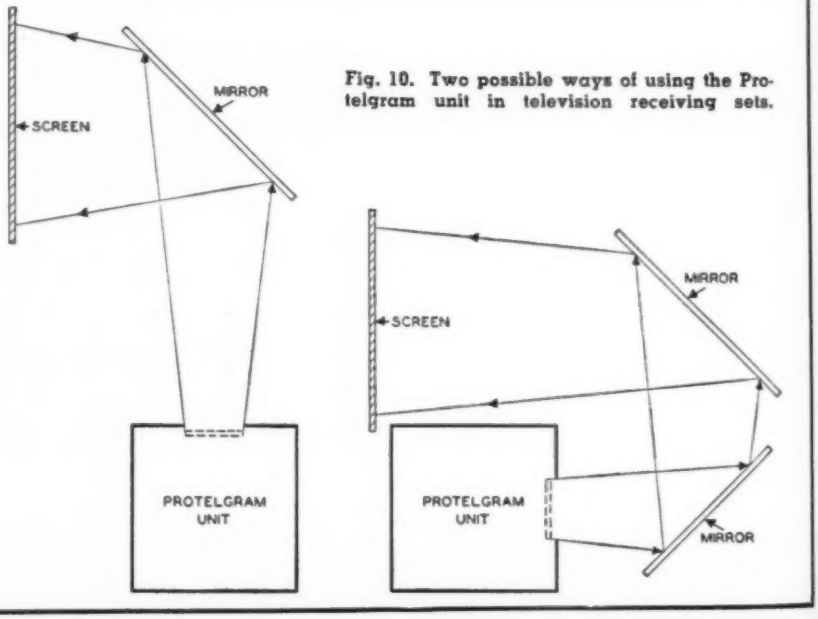


Fig. 10. Two possible ways of using the Protelgram unit in television receiving sets.

A throw distance of 31" from the corrector lens to the viewing screen is required to produce an image 12" x 16". Extending behind the tube face and for 7½" beyond the 9" dimension of the optical unit is the alignment assembly. This carries the tube and socket, focus, horizontal and vertical deflection coils and aligns the tube optically by means of three screws, which can be locked to insure good mechanical stability. Horizontal and vertical deflection coils are inside the optical unit; the focusing coil is outside. The tube is firmly seated in the plastic coil forms for the deflection coils, which are designed so that linear current will produce linear deflection over the full picture area.

A special small-size cathode-ray projection tube (3NP4) was designed for this unit. The tube screen diameter is 2.5 inches from which is obtained a 1.4 x 1.86 inch picture. 2.5 inches appears to be the smallest practical size from which an enlarged image can be obtained. The tube uses magnetic deflection, magnetic focusing and 25,000 volts for acceleration. The spot diameter at the tube face is 0.003 inches and this permits 450 line resolution to be obtained. The high-voltage anode terminal consists of a button in a glass cup sealed to the cone of the tube. The glass cup lengthens the external leakage path from the high-voltage contact to the coils thereby minimizing any tendency for arc-over to occur. The outside of the cone and part of the neck are covered with a conductive coating that can be grounded. This outer coating, together with the conductive coating inside the tube, forms a 300 $\mu\mu$fd. condenser which can be utilized for filtering of the high voltage. The neck of tube is quite narrow and, in conjunction with a deflection angle of only 40 degrees, permits full deflection to be achieved using only as much deflection current as ordinarily supplied to a 10BP4 direct-viewing tube operating at 9 kv.

A 25 kv. second anode is needed for the 3NP4 with better than average stability. Since existing types of high-voltage power supplies were found to be unsatisfactory, a new, compact unit was designed having low weight, small size, great stability and no r.f. radiation. See Fig. 7.

The flexibility of this particular design is illustrated by two possible arrangements, Fig. 10. In the left-hand illustration, the beam emerging from the corrector lens is folded once more by a second mirror tilted 45-degrees. For an even more compact arrangement, the beam can be folded twice after leaving the "Protelgram" unit.

For future projection television receivers, the immediate objectives are: greater light intensity on the viewing screen, better contrast, and increase in horizontal and vertical viewing angles.

Projection television, while presenting more problems must, nonetheless, keep pace with direct view receivers.

Spot Radio News

(*Continued from page* 16)

gle stage. The *RCA* specialists emphasized that their system should not be cited as a means of obtaining higher power from many small tubes, but rather as a means of increasing transmitter output when existing tubes have been improved so that they could handle more power.

Another approach to the high-power problem was demonstrated at a special engineering-press meeting by *Westinghouse* at their Lansdowne, Maryland, plant. In this method, described as a *Symmetron* power amplifier, tubes are operated in parallel and symmetrically inserted into coaxial tanks (cathode and plate). Each tube, therefore, sees the same electrical and mechanical configuration for all operating frequencies. Thus the design lends itself to multiple tube operation. Two to ten tubes or more may be operated in parallel without affecting the circuit symmetry. This type of circuit is associated with simplified wide-range tuning, a 50-kilowatt tank requiring only three adjustable tuning controls, cathode tuning (shorting bar), plate tuning (shorting bar), and output coupling (condenser). These controls are motor driven and tune through the complete FM band of 88 to 108 megacycles without mechanical adjustment of the tank, which is in contrast to the conventional FM grounded-grid, push-pull amplifiers, using two-wire transmission line tanks, where even at lower power levels, up to nine adjustable controls are required.

Using the present types of tubes, the *Symmetron* system was said to provide powers of 75 kw. in the standard FM band; 25 kw. in the 54 to 88 mc. TV band; 10 kw. in the 174 to 216 mc. TV band, and for black and white or color TV, one to two kilowatts in the 500-1000 mc. spectrum. *Westinghouse* engineers declared that these power levels were from one to one-and-one-half times greater than those available with current equipment designed to operate on the ultra-highs.

Ultra-high telecast studies are continuing at a merry pace, too, with *NBC* and the Washington consulting engineering firm of *McNary and Wrathall* preparing four setups for tests. *NBC* has asked the FCC for permission to install a 846-854 mc. transmitter, using a rated visual power of 100 watts and a peak carrier power of 400 watts, at their Princeton labs and another ultra-high unit, operating on 529 mc., installed in the vicinity of Bridgeport, Conn., which is expected to have an effective radiated power of between 15 and 20 kilowatts. The other two experimental stations are being planned for Scranton, Pa., and Pawtucket, R. I., with a frequency of 515 mc. used for a pulse-modulated visual signal having a power of 5 kilowatts. Slotted cylindrical transmission antennas with power gains of ten

are expected to be used. WQAN will conduct the Scranton tests and WCFI, the Providence studies. It is believed that about $10,000 will be spent for each experiment.

TRENDS IN MINIATURIZATION in industry and the military were accented at the IRE national convention exhibits at the Grand Central Palace, New York City. The U. S. Navy displayed a complete receiver, formerly requiring 12,160 cubic inches, compressed into a volume of 3,150 cubic inches, with no efficiency lost in the transfer. A ten-tube receiver, weighing but one pound and sealed in a plastic case, three inches by six inches by one inch thick, was also on view. An answer to every serviceman's prayer, a test kit with all of the basic tools in a container less than a foot long, was also shown by the Navy. Containing fountain-pen like instruments serving as voltmeters, ohmmeters, soldering irons, vacuum-tube testers, signal generators and tracers, plus other test essentials, the kit weighs about twenty-five pounds and is ten by ten by nine inches in size.

Describing this *dream kit*, E. J. Nucci of the Navy Bureau of Ships, said that the kits are being expanded a few inches and increased in weight about two pounds to include a 'scope, to provide maintenance and service for practically every type of first-aid problem.

THE AVERAGE LISTENER prefers the full frequency range in speech and music, and not a restricted frequency range, Harry F. Olson of *RCA* Labs, said at the IRE meeting during a talk on the reproduction of sound.

Analyzing this and other related factors, Olson disclosed that there are six physical aspects of a musical tone: intensity, fundamental frequency, overtone structure, duration, growth and decay, and vibrato. He said that an examination of these physical aspects shows that speech and music are exceedingly complex, and since sound-reproducing systems involve all manner of mechanical vibrating elements, one would expect deviations from true fidelity of reproduction. However, Olson continued, it is truly remarkable and fortunate that tremendous deviations from true reproduction may be made and we may still retain a system which is acceptable by the average listener.

Olson pointed out that there are seven types of defects which must be considered in order to reproduce the physical characteristics of a musical tone, and which should not be present in a distortion-free system: amplitude distortion, nonlinear distortion, phase distortion, transient distortion, noise, directional pattern of reproducers, and seven conditions of deviations (single channel system, special distribution, accoustics of two rooms—the pickup studio and listening room, limited dynamic range, microphone placement and balance, difference in

level of the original and reproduced sound, and volume effects of rooms).

INTERFERENCE from auto ignition and electrical equipment, a serious problem in reception and particularly television, is receiving legal attention in Great Britain with a Wireless Telegraphy Bill, which would make it mandatory to equip all units which may radiate electromagnetic energy with suppressors.

Discussing this move during an interview in New York City, Dr. R. L. Smith-Rose, director of research of the department of scientific and industrial research, London, and formerly vice president of the IRE, said that the bill would undoubtedly pass and guarantee interference-free reception. According to Dr. Smith-Rose, all manufacturers of accessories or automobiles which might radiate will have to secure an approved certificate, indicating that tests have been made to assure radiation-free performance.

In a query covering the 405-625-819 line debate now raging across the continent, Dr. Smith-Rose said that the British industry has not changed its opinion as to the virtues of the 405-line method, since it was believed that this standard was the most efficient in relation to cost and ether space occupied. The 625-line system, which seems to be favored by those in Sweden and Germany as well as Belgium and Switzerland, and the 819-line system popular in France, is not practical for Great Britain, according to Dr. Smith-Rose. The 625-line system, which has been developed by Philips of Eindhoven, and uses a 6-mc. bandwidth with two-to-one interlacing, does have many interesting possibilities according to other continental experts who were interviewed during their recent attendance at a series of lectures on television in this country.

FORMER PRESIDENT HERBERT HOOVER was honored at a recent luncheon of the Radio Executives Club at the Hotel Roosevelt, New York City, for his pioneering work in radio legislation and control while Secretary of Commerce and as President.

As tokens of esteem, the club presented Mr. Hoover with the original microphone that he used on January 15, 1921, at the European Relief dinner in the Duquesne Club, Pittsburgh, when he spoke over KDKA, and the microphone used at the White House while he was president.

A galaxy of outstanding technical, administrative, and entertainment personalities joined in the tribute, including Laurence Tibbett of the Metropolitan Opera; David Sarnoff, *RCA* Chairman of the Board; Walter Evans, president of *Westinghouse Electric* broadcasting division; Frank Stanton, *CBS* prexy; Wayne Coy, FCC Chairman; Norman Luker, North American Director of *BBC;* Ted Streibert, WOR prexy; Allan Hoover, son of Mr. Hoover; A. D. Willard, executive vice president of NAB; Ted Husing, fa-

mous sports announcer; Carl Haverlin, president of the club; and Frank M. Russell, vice president of *NBC* in Washington, D. C.

THE EXTENSIVE PREPARATIONS required for that epic inaugural TV network program a few months ago were disclosed recently in a special report.

According to this review, more than 550 long-line telephone experts were trained for the event, who for two months prior to the telecast were engaged in lining up and testing the coaxial links. The tests, which involved many changes and adjustments, went on continuously right up until the program was scheduled to go on the air.

The *Illinois Bell Telephone* number two toll building in Chicago was the key center for much of the activity. For into the 157-foot basement vault of the building was placed the Chicago-Cleveland-New York and Chicago-St.-Louis coaxial cables. Although this building and its equipment were designed to handle telephone conversations, the center was established to provide a headquarters to monitor and switch television programs.

The report showed that 540 amplifiers had to be installed along the routes and an additional system of 250 amplifiers were required for the television terminals in the telephone buildings in each city of the network.

Today, the network, still in the improvement stages, but providing excellent services, links fourteen cities and 30 stations and serves one-fourth of the nation's population, a remarkable record of engineering progress. . . . . L. W.

Queen-Dona (CQ) Grace Burbage, Humboldt College co-ed, was chosen to reign over the all-male student body of California State Polytechnic College at the annual Poly Royal celebration April 29 and 30. Miss Burbage shown seated at the controls of the college short-wave station, sent invitations to all hams to inspect the college's radio and electronics facilities during the two-day celebration on the San Luis Obispo campus. This is a regular, extra-curricular activity of the student body, planned, managed, and directed by the student leaders and is recognized nationally as a pioneer and model of vocational education of the college level.

Don Lee Studios

(*Continued from page* 37)

vey the traffic problem and equipment needs of the expanding network. The outgrowth of many round table discussions was master control equipment with a switching system of over 800 possible program combinations requiring 821 relays, 49 amplifiers, 850 indicator lamps, 2500 jacks, and 13 volume indicators. The equipment contains facilities for handling 12 studios, 3 announce booths, 4 recording channels, 4 simultaneous remote programs, 96 remote connections, 7 incoming networks, 10 outgoing networks, and equipment for special facilities. Despite the complexity, there are tell-tale indicators, automatic features, and convenient control arrangements to permit its entire supervision by only one man.

In regard to the automatic features, it is normal to allow 20 seconds after cue for fill to the network before switching, permitting the master control operator only 10 seconds to perform his many functions. He now can press *Delay Master* buttons on cue, which will automatically switch the network 20 seconds later, leaving him free for other duties. The equipment has its own dust-free air conditioning system.

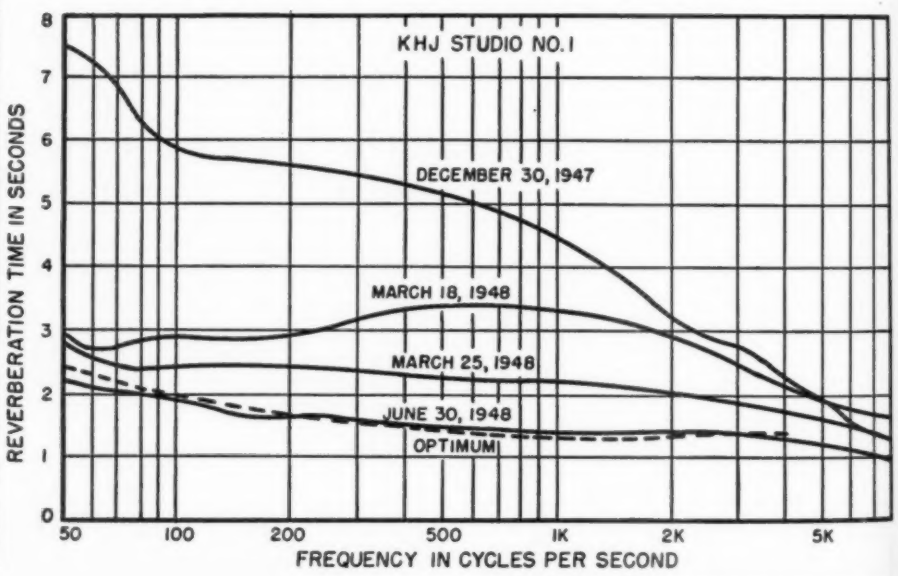
A mixing console which would incorporate facilities necessary to the needs of radio production had been planned for several years. Many schematics were drawn and revised. It was desired to have the greatest amount of flexibility and facilities for fulfilling the demands of all types of programs, but unfortunately the mixing console became excessively complicated. Often it has been said that an engineer's job is one of making the best compromise and here a compromise was necessary.

With this in mind, less frequently used special effect equipment was deleted with the idea of housing such equipment in a separate cabinet so that it could be wheeled to the side of any console when the occasion demanded. The desk circuits were treated to gain maximum flexibility through the use of jack bays. The eight channel mixer, operationally speaking, was simplified by keys, which, by choice of the technician, split the board into channel groupings controllable by sub-masters. On certain types of programs this greatly facilitates mixing. For example: the multi-microphone pickup of an orchestra, controlled by one hand, can be balanced against the instrumental solos or vocal microphones controlled by the other hand. The sound microphones can be balanced against the cast microphone in the dramatic programs.

Through the continual exchange of ideas with *Western Electric Company*, there emerged a control desk which in one year of trial installation has proven very satisfactory. The readily accessible plug-in amplifiers have made the occasional service requirements very simple.

The equipment installed in the KHJ network and FM announce booths is to provide for fading into or out of programs, giving identification and spot announcements, playing transcribed commercial spots or recorded fills in case of program failure, and cueing and monitoring necessary to the operation. The Don Lee Broadcasting System production department and announcing staff studied the possible layout of equipment fulfilling these needs with the intention of improving the ease and accuracy of operation. The number of controls appearing on the equipment was held to a minimum to avoid confusion and the placement was based on frequency of use. Much consideration was given to the slope

Fig. 1. A typical family of curves resulting from reverberation tests made during the course of construction. Here, for the first time, a building was constructed to the optimum reverberation characteristic as indicated by the curves.



of the control panel and location of the volume indicator to further facilitate operation. It was decided that a control desk similar in shape to that developed for the small studios would be ideal with circuit and control modification for use in the announce booths.

A need existed for control room equipment associated with the small studios used in commentary and round table discussion types of programs, preparation and playback of delayed broadcasts with facility for cut-in announcements, and assembly of record shows with the announcer (disc jockey) working in the control room or in the studio with a technician at the controls.

The design philosophy was that of simplicity, ease of operation, and dependability. With an intent to minimize operational errors resulting from poorly placed and excessive numbers of controls and switches, a careful study was made to determine the most frequently used controls and the most convenient location for each with the least hazard to smooth operation. The aim was to satisfy program production demands with the minimum number of controls in order to facilitate fast and accurate operation. To insure greater dependability, each part was studied as a potential trouble maker. For ease of operation, two turntables were built into one side of the desk, and a third was placed in a separate cabinet on the other side of the operator as optional equipment. Moreover, the physical shape and color of the control desk were worked out with *Western Electric* engineers to give eye appeal and modern design rather than just the "technical look."

Mutual Don Lee is convinced that the care and effort expended in the design and construction of this network center have produced the ideal home for its operations in Hollywood. The acoustic characteristics of the studios add measurably to the quality of the broadcasts. The provisions in the building for technical services and the careful planning of the layout for storage, for entrance and exit of the public, and for the managerial functions of the networks are of great value, and finally, the audio system brings simplicity and efficiency to program production and dispatching.—30—

"But all I said was that her battered old chassis was sprung and bulged where it shouldn't."

Mac's Service Shop

(*Continued from page* 52)

tion that ordinarily separates the line from the chassis? What's the resonant frequency?"

"Let's see if you can figure it out for yourself," Mac suggested. "First, what's the chief characteristic of a series-tuned circuit?"

"A very low impedance at the resonant frequency," Barney said promptly; "so I suppose that this circuit is for the purpose of furnishing a very low impedance path between the chassis and 'B-minus' at one particular frequency."

"So far, so good!" Mac encouraged. "And what particular frequency is it that we want to be sure is tied down so that it cannot go wandering around through the receiver and cause us more trouble?"

"The i.f. frequency?" Barney guessed.

"That's right. Because of the high gain of the i.f. amplifier, it is essential that the i.f. signal stick strictly to the path intended for it. The series-tuned circuit is usually mounted physically near the cathode return of the i.f. amplifier, and so it serves to prevent degeneration at the i.f. frequency as well as to prevent oscillation. In short, you might say that the series-tuned circuit is employed as a particularly effective bypass."

"It is rather funny that you should ask about that at just this time, though," Mac continued, "for this letter I am holding contains a descriptive bulletin on the *Sprague* line of resonant condensers that were designed to contain in a single compact unit that tuned circuit you have there. These condensers, which come in .05, .1, and .2 μfd. values, have *built-in* inductance so that they resonate at 455 kilocycles. At this frequency, the impedance of a typical .2 μfd. unit is less than a quarter of an ohm."

"If a fellow had to replace one of those resonant condensers, he ought to use an exact duplicate, right?"

"Right!" Mac said. "For if he doesn't, he is likely to have oscillation trouble."

"Do they look any different from ordinary condensers?"

"Well, the ones that bear the *Sprague* name come in yellow tubes and are marked 'resonant' for identification. The other day, though, I ran across one of the units that was in a slate-gray tube and just had the word 'special' stamped on it."

Barney shook his head sadly. "It is not enough that we have resistors that look like condensers and condensers that look like resistors. Now we gotta have tuned circuits that look like condensers yet!"

—30—

A USEFUL SWITCHING CIRCUIT

By JACK D. GALLAGHER, W5HZB

AN ARTICLE by the writer which appeared in Radio & Television News, June 1948, entitled "Another Method of Power Supply Control" presented a simple solution to the problem of turning the plate voltage on last and off first by three switches. For reference, the switching arrangement is shown in Fig. 1A.

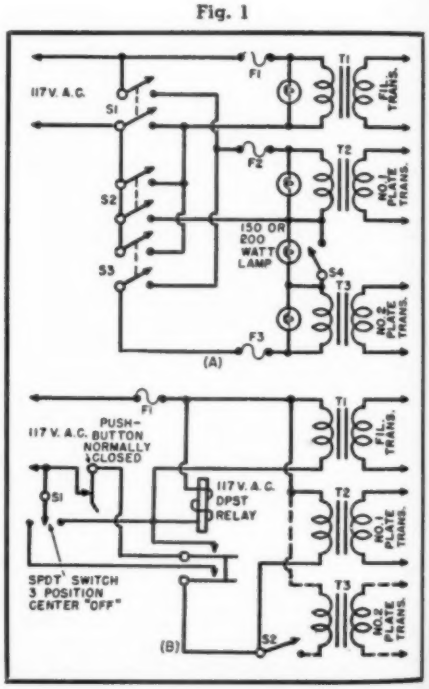
Removing S_3 of Fig. 1A will provide a method of "plates on last, off first" for T_1 and T_2. Suppose, however, that these same features could be accomplished with just one toggle switch instead of two. Or, if all three transformers were to be used, it would still simplify matters if two toggle switches would serve the purpose of three.

The diagram of Fig. 1B will serve the purpose quite well. The relay is connected in a lock-up circuit by throwing S_1 to the right. Since only a momentary connection is needed to turn on the filaments, S_1 can be a 3-position switch with a momentary action on one side. By switching S_1 to the left, primary voltage can be applied to T_2. If S_1 were switched to the left at first, nothing would happen since the primary of T_2 is open through the relay contacts. If for some reason S_1 is to the left and the relay coil goes open, T_2 is turned off as well as T_1, both simultaneously. If the plate voltage is left on (S_1 to the left) accidentally, the push-button will turn off both voltages.

S_2 in Fig. 1B controls T_3, if it is used. Since the filament voltage must be applied before either T_2 or T_3 will operate, there is no possibility of turning the plate voltage on first, or off last. If both S_1 and S_2 were "on" (T_2 and T_3 operating), all voltages would be turned off when the push-button was opened and nothing could be turned on first except the filament transformer T_1.

—30—

Fig. 1



International Short-Wave

(*Continued from page* 142)

Azores—CSX2, 4.845, Ponta Delgada, heard 1715-1900; CS9MB, 11.090, heard 1415-1500. (Peddle, Newfoundland)

Barbados—VPR-9, 15.035, heard recently calling VRR-4 at 0740; heard another day 0745 contacting same station. (Ferguson, N. C.)

Belgium—Brussels, 17.845, heard recently calling ABC, New York, at 1730. (Beck, N. Y.) ORG, 19.230, heard to LSMS at 1300. (Peddle, Newfoundland)

Bermuda—ZFD-2, 10.390, works WNB; ZNX-2, 20.715, works London, and ZNU-4, 10.150, works WNB; all located at St. Georges. (Peddle, Newfoundland)

Brazil—Radio Jornal do Comercio, Recife, confirmed report via registered airmail QSL card. Transmitter is Marconi SWB 10, input 15 to 20 kw. high-level plate modulation. Antennas are 258 degree *Beverage* array for 19-, 25-, 31-, and 49-meters. Input at time of report was 15.18 kw. Stations, frequencies, and schedules listed PRL-6, 780 kcs., 0600-2100; ZYK-2, 15.145, 0600-1400; ZYK-3, 9.565, 0600-1200, 1400-2100; ZYK-2, 6.085, 1600-2100; advised that ZYK-3 also operates at times on 11.825 but is subject to heavy QRM there. (Rosenauer, Calif.)

What appears to be PYZ-2, *Emissora do Distrito Federal*, Rio de Janeiro, on 9.220, is heard 1800 or 1815 to 1830 sign-off. (McPheeters, La.) Also heard in Texas by Stark.

British Guiana—ZFY, about 5.985, Georgetown, heard in New York at 2000 and signing off 2045 with "God Save the King." (Weisberg) Relays BBC news 1800. (Ferguson, N. C.) Good level early mornings, also.

British Honduras—Ferguson, N. C., says ZIK-2, 10.598, Belize, seems to be back on old schedule as has heard it opening several times lately 1332 with news; was heard one day 1250 calling VQNA at 1331, had news which ended 1343, then called VQNA again; fair signal.

Bulgaria—Radio Sofia, 7.671, is still broadcasting 2250-0300; *no English noted;* improved signal recently. (Hagen, Ala.) Has setting-up exercises 2320, Eastern music 2330, news in Bulgarian 0000, then music (this time mostly marches of Slovak type). (Beck, N. Y.) Is heard in Newfoundland 1650-1700 with news. (Peddle)

Cameroon—"Ici Radio Douala," 9.160, signs on 1300 with march, then gives call *"Allo, Allo, Ici Radio Douala";* programs feature much recorded music. (Pearce, England) On Sundays appears to run 1430-1600. (Peddle, Newfoundland)

Canada—VE9AI, 9.54, Edmonton, Alberta, has news 0000. On West Coast, says Dilg, Calif., can be heard at weak level mornings after *Radio Australia* leaves the channel 0845.

Cape Verde Island—DeMeyer, Mich.,

has received verification (making his 208th country verified!) from *Radio Clube De Cabo Verde*, Praia CR4AA, heard on 5.910 some months ago; sent a beautiful card, gave frequency 6.024 and schedule of 1350-1500; however, Pearce, England, lately heard this station to 1700 on approximately 5.895 through bad CWQRM; DeMeyer heard it on 5.910 at 1600-1700. Swedish sources list this one with only 100 watts.

Ceylon—*Radio Ceylon* was recently heard at 1100 on 15.12 and 17.73 (*not* 17.77). (Balbi, Calif.) Has BBC news relay 1100 and some days is readable here in East on 15.12. The Sunday transmission to the British Isles is best in East now on the 16-m. outlet, since 15.12 at that time suffers severe QRM; time 1130-1330.

China—Nanking's former XGOA, 9.730, no longer giving call, still heard in California 0900 with usual news. (Dilg) This outlet is fair level in West Virginia early mornings, but usually has interference from around 0625. Balbi, Calif., recently heard the 9.730 channel 0500-0730, all native, strong level, but says there is no sign of the 5.985 outlet now.

A Communist-controlled outlet on approximately 7.500 was recently heard by Dilg, Calif., with *English* starting shortly before 0900; may be old XNCR.

GDX-AREN, house organ of Goteborgs DX-Klubb, Sweden, reports *"Shanghai Broadcasting Station"* heard 0900-1000 sign-off on 11.705. *(I am anxious for full details on current frequency and schedule of former XORA, Shanghai.*—K.R.B.)

BCAF, 8.995, is believed to be old XGAF, Nanking Air Force, moved from 7.102. (Dilg, Calif.)

According to data received directly from the station, *Radio Hong Kong* has two m.w. transmitters of 2 kw. and one s.w. transmitter (ZBW-3) of 2.5 kw.; frequencies are ZBW, 645 kcs., transmitting the *English* Program 2330-0100, 0500-1015; ZEK, 640 kcs., transmitting the Chinese Program same hours; ZBW-3, 9.52, carrying the *English* and Chinese Programs of ZBW and ZEK at same hours listed for m.w. outlets. But on Sundays, the *English* Program starts 2 hours earlier, that is at 2130, and Chinese Program begins Sundays one-half hour earlier, that is 2300 (Ghurkali Program). The s.w. outlet, 9.52, is shared between *English* and Chinese Programs. News scheduled 0015; BBC's, GOS relay of world news and news analysis 0600; BBC's GOS relay of *"Radio Newsreel"* 0900. Summer time schedule listed *English* 2200-2330 (Sundays) and other days 2230-2330, 0530-0630, 0715-0915, and Chinese at 2330-0000, 0400-0530, 0630-0715. (Gaynor, Calif.)

XGYA, 7.990, heard 0530 with relay of XNCR in Chinese news, music. (Sanderson, Australia)

Desouza, Singapore, says North Shensi New China Station is heard on 9.000 from 0430 to 0900; no call-sign heard; has news 0845 to closedown at

which time identifies; reception very poor. *(Radio Australia)*

Colombia—HJCX, 6.020, Bogota, has returned to the air; was off for a while following revolution in that country. (Beck, N. Y.) HJBB, 4.815, *Radio Cucuta*, heard 0500-2200. HJGF, 4.845, Bucaramanga, signs off 2230 giving sign-on as 1300. (McPheeters, La.) HJKJ, 6.160, good signal, identifies in Spanish 1900. (Hankins, Pa.) Bogota, 11.68 (measured 11.682.5) fair signal 2015-2120; HJCT, measured 6.199, Bogota, good level 2300-2310 sign-off.

Cuba—CMQ Network (which operates COCQ, 8.700), recently acquired two new announcers, Alberto Gandero and Francisco Forcade, both of whom have been for several years on the NBC staff in New York. CMQ Network won the 1948 Cuban radio awards for the best dramatic program (El Derecho de Nacer), the best actor and actress, the best comedian, the best announcer, the best news commentator, and the best program of service to the Republic of Cuba. (Bachman, Pa.)

Cyprus—Sharq-al-Adna, 6.135, 6.170, 9.650, all good 2255 sign-on; 6.135, 6.170 fade out around 0015 but 9.650 is heard with fair to good level to sign-off 0130. (Beck, N. Y.) The 6.790 channel is scheduled in parallel. Latter is heard in Newfoundland by Peddle at 1400-1445.

Forces Broadcasting Service, Kakatamia, 7.220, continues to test Saturdays 1700-1900, answers listeners' reports that day 1800-1815, and asks for reports "from anywhere." (Pearce, England)

Czechoslovakia—Hagen, Ala., says "The only time I have been able to receive Prague is on 11.760 between Melbourne's transmissions—at 1115-1200, that is—broadcasting news in various languages." At the time this was compiled, the daily North American transmission 1850-2000 was on 9.550, excellent at start but soon

A regular, valuable contributor to ISW is D. W. McPheeters, Louisiana, who relaxes here as he tunes his National Receiver. Mac, who is a member of the Romance Language Department at Louisiana State University, is quite handy in translating material for your ISW editor.

QRM'd by Paris; last 20 minutes is a relay from Bratislava; news 1900. *Radio Australia* reports the 11.840 channel has been heard in Australia around 0045, closed down 0103.

Denmark—OZF, 9.52, Copenhagen, often heard with news 2230, good signal. (Ferguson, N. C.) According to announcement, uses 15.165 on Tues., Thurs., Sat. 0500-0600 to Far East. (Huse, Washington) It is believed this is the *new* 50 kw. transmitter which is used other times on 9.52.

Dominican Republic—HI2A, Santiago, checked recently on 9.682, signing on 1450 with announcements in Spanish. (Ferguson, N. C.)

Ecuador—Clayton Howard, engineer at HCJB, Quito, informs that operations have been expanded on the 16-meter channel. Is now on the air daily *except* Mondays on 17.890 with 10 kw. and beamed to Europe 1200-1545 (Sundays begins 1130). *The station desires reports from European listeners, and believes reception in Europe will "pick up" as summer comes on.*

Finland—Helsinki, 15.19, still has news daily 0715 but now suffers terrific QRM from AIR, Delhi, same channel. Balbi, Calif., says the 2200-0000 transmission is heard with excellent strength. Fargo, Georgia, reports this one at excellent level 1145-1245, all-Finnish.

France—European Service of Paris on 7.280 signs off 1600. Paris heard 1515-1645 on 9.680, 11.845 to French East and Equatorial Africa. (Beck, N. Y.) The 15.350 channel heard in French from tuning 1130 to sign-off 1213, good signal. (Ferguson, N. C.)

French Equatorial Africa—Radio Brazzaville, 9.440, 9.984, 11.972, is scheduled 0000-0230, 0500-0745, 1100-1700, 1705-1825, 1830-2000; sometimes 6.024 is in parallel as at 0000-0230 and 1705-1825 periods; 17.840 is in parallel *except* at 1600-2000. In recent DX session, Leopoldville gave call letters of Brazzaville as FZ1 (*not FZI*). (Beck, N. Y.)

French Indo-China—Radio Saigon, 11.78, heard with news 1830, announces next news for 1930. (Pearce, England) The 1830 period is heard here in West Virginia, but soon is buried in QRM. Balbi, Calif., reports 6.10 and 7.21 in parallel with Saigon's 6.165 to 1030 sign-off.

Sanderson, Australia, still lists Pnompenh on 12.36 at 0530 with Chinese news at dictation speed, then music; she gives *Radio Dalat* on 6.18 at 0700 with news in French, fair signal, and Saigon on 7.21 at 0545 with news in French.

French Morocco—Radio Maroc, 6.005, Rabat, heard 0150-0215 fade-out in Ontario with Arabic program. (Alfred) Heard in Arabic 1530-1600, in French 1600-1630. (Peddle, Newfoundland) Has news in French 0300.

French West Africa—Radio Dakar, 11.898, heard well from 1315 to 1700 sign-off after headline news in French; Saturday and Sunday is heard to 1800. (Pearce, England) Heard in Newfoundland 1330-1700. Dakar is

heard on 15.405 some days phoning Paris 1015. (Peddle)

Germany—Leipzig, 9.728, heard opening 2258. (Stark, Texas)

DTFC, 15.105, Munich, heard point-to-point and with relay to "Voice of America" in New York 1030-1100, good signal. (Sutton, Ohio)

Stuttgart recently heard 0845 on 6.030, moved from 6.180; has news in German 1145. (Pearce, England) Sweden confirms this change in frequency. (Swedish DX)

Gold Coast—Kumlin, Sweden, has heard ZOY, 4.915, Accra, at 1235-1302 with program of native songs, then news in *English* (1800), announced, and then signed with national anthem; QSL card received.

Greece—Hagen, Ala., says Athens, 9.605, runs to 0315 on Sunday with all-religious program; some days signs on 0000, others 0030. Beck, N. Y., comments that now has fine modulation but that there still is a slight hum on the channel. Reports from various points in East indicate improved signal from *Radio Athens*, 15.345, in daily period to North America 1730-1830, news at start.

Pearce, England, reports *"Hona Larissa Radio Fonicos Strathmos"* on 6.740 daily to closedown with march 1430; asks for reports to The Greek Democratic Army Broadcasting Station, Larissa, Greece; heard signing on 1100; has some Arabic, some Western programs. Nattugglan, Sweden, comments that announces in French *and English*. Heard by Peddle, Newfoundland, 1230-1500. (Closedown may be irregular in view of above reports.)

Holland—PCJ, 21.48, heard opening in Dutch 0943 and closing down 1031 with Dutch National Anthem, good level. (Ferguson, N. C.)

Eddie Startz of PCJ informs me that by this time the *new* 40 kw. transmitter should be in operation; station is on a field near the small town of Lopik close to city of Utrecht where one of the Home Service transmitters is located.

Current schedule for the *"Happy Station Programs"* is—to East and Near East, Sundays and Wednesdays 1030-1200, 17.77, 15.22, 6.02; to Africa and South America, Sundays and Wednesdays 1600-1730, 11.73, 9.59, 6.02; to North America, Sundays and Wednesdays 2200-2330, 11.73, 9.59, 6.02; to Pacific, Australia, New Zealand (also heard in Asia), Tuesdays 0330-0500, 21.48, 17.77, 15.22, 6.02. Reports will be welcomed by PCJ at P. O. Box 137, Hilversum, Netherlands.

India—Delhi, 15.79, has recently been good level here in West Virginia late mornings to closedown 1230; has last news 1215.

On Saturdays there is a program of request musical selections at 1000-1030 on 9.590 and other AIR channels in use at that time. (Rosenauer, Calif.)

Indonesia—Radio Indonesia, 19.345, Batavia, is heard well now 1100-1300 (may sign off 1230 some days); 15.150 is in parallel although some times is buried by BBC on an adjacent channel. (Fuller, R. I.) I note that on the

19.345 outlet there are frequent announcements in both Dutch *and English*. Recently, the Batavia outlet on approximately 11.000 has been fairly good here in West Virginia for the 0600-0700 *English* period; 15.150 is in dual.

Pearce, England, has heard *Radio Indonesia*, 15.150, Batavia, at 1800 with clock striking; often has North American recordings from 1800, and has been heard from 1745 after sign-off of US station on that channel.

Balbi, Calif., recently noted an Indonesian on 9.78, signed off 1000; believes might be *Radio Sario* moved from 9.72.

Radio Indonesia, 9.550, Makassar, heard recently on West Coast 0900-1000 sign-off, good level, musical program, announcements in Dutch. (Rosenauer)

Rosenauer, Calif., flashes that he has recently been hearing a *new* Indonesian on approximately 11.110, first heard 0900-1000 sign-off with good signal; program was music; at close clock strikes eleven and station then signs off with Bing Crosby's recording of "Just a Prayer Away"; another day was heard 0600-0700 with announcements in Indonesian and Dutch.

YDH-2, 11.034, Semarang, heard 0800-0830. (Alfred, Ontario)

Iran—Nattugglan, Sweden, reports Khoramabad on 6.845 at 1130-1230 on two days of the week (probably Monday and Thursday). A recent Swedish DX session from Stockholm said the Regional Broadcasting Station for the province of Fars at a place called Shiras is transmitting on 7.960 Mondays and Thursdays 1130-1200; heard in Sweden.

EQC, 9.680, Teheran, heard around 2330; all-Persian. (McKay, Fla.) I checked this channel and found a station opening there 2330; seemed to have news in Persian 0000; rather strong signal.

Teheran, 15.100, is usually good level in daily 1340 newscast.

Israel—In verifying for DeMyer, Mich., Kol-Israel, Tel Aviv, listed frequency of 6.820 scheduled 2345-0100, 0430-0715, 1015-1530, news 0700, 1500. DeMyer hears this one well from 0000.

Italy—Rome still has *English* session 2015-2055 with news 2015, good on both 9.630, 11.810. (Beck, N. Y.) Heard on 9.630 at 1510 in foreign language; at 1515 announced program of Arabic; at 1544 announced in *English* and gave news, ending *English* period 1630, continued in Italian. Heard on 11.810 closing program for Latin America 1935 and leaving air. (Ferguson, N. C.)

Jamaica—ZQI, 3.480, Kingston, heard 2100-2200. (Peddle, Newfoundland)

Japan—Tokyo, 9.505, heard 0545, fair signal. (Alfred, Ontario)

Here are current Japanese calls, frequencies, and schedules as received airmail from Howard H. Boyle, Tokyo, Chief Engineer with AFRS.

1st Network—JKH, 7.257.5, Yamata, 5 kw., 1525-0900; JKI, 4.910, Nazaki, 5 kw., 1555-1715, 0255-0900; JKI-2, 9.655, Nazaki, 5 kw., 1725-0245.

2nd Network—JKJ, 7.285, Nazaki, 5 kw., 1625-1800, 0255-0900; JKM, 4.930, Kawachi, 5 kw., 0255-0900; JKM-2, 9.695, Kawachi, 5 kw., 1625-1800.

Repatriates—JBD, 9.505, Kawachi, 7.5 kw., 0255-0900; JBD-2, 9.560, Kawachi, 5 kw., 0455-0900; JBD-3, 15.225, Kawachi, 7.5 kw., 1730-0245; JBD-4, 15.235, Kawachi, 5 kw., 1750-0245.

AFRS—JKK, 6.015, Nazaki, 5 kw., 1615-0907; JKL, 4.860, Yamata, 5 kw., 0355-0907; JKL-2, 9.605, Yamata, 5 kw., 1615-0345.

Korea—HLKA, 7.935, Seoul, often is R6-7 at 1630 with *English* lesson, presumably for Koreans.

FUSING HORIZONTAL OUTPUT CIRCUIT IN TV RECEIVERS

By MATTHEW MANDL

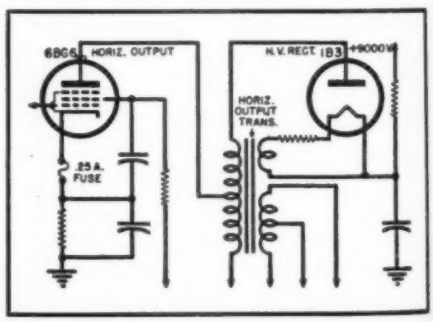
A COMMON trouble in television receivers having tubes larger than 7 inches has been the failure of the 6BG6 horizontal output tube. The high potential pulses present on the plate of this tube, due to the fly-back process of the high-voltage power supply, do much to produce ionization and cause the tube to go gassy more quickly than if it were used in other services. Once the tube goes gassy, excessive current flows through it, and this in turn will cause over-heating of the horizontal output transformer.

Most present-day sets have this circuit fused to prevent damage to the output transformer. A number of television receivers manufactured during the past several years, however, have no fuse in this circuit, and, in consequence, ionization of the 6BG6 will burn out the horizontal transformer if the receiver is not shut off in time.

When a television receiver is brought in for repair, this circuit should be checked and a fuse inserted if none has been included by the manufacturer. A .25 ampere fuse is sufficient to open the circuit when excessive current flows through the tube. A No. 44 pilot bulb can also be used, since this has a rating of. 25 amperes. A No. 47 bulb will also prove satisfactory and will usually glow dimly when the set is turned on.

The fuse can be inserted in several places in the circuit, though the easiest is probably the cathode circuit. The lead going directly to the cathode can be unsoldered, and the fuse inserted as shown in Fig. 1. -30-

Fig. 1.



Lebanon—Radio Beirut, about 8.020, heard in New York 0045 with news, not sure of language being used. (Bellington, N. Y.)

Luxembourg—Radio Luxembourg, 15.350, heard 0715 with sponsored program in French. (Ward, England) Is fairly good level in America, appears to end transmission 0835.

Malaya—Stark, Texas, recently heard *Radio Malaya,* Singapore, 4.825, identified 08C0 (in *English*). A station he recently heard on 7.220 (in *English*) 0730 also appears to be *Radio Mayala.* Balbi, Calif., flashes that the 7.220 channel is strong on West Coast to 1030 sign-off, relays Blue Network. Also heard by Dilg, Calif.

Radio Malaya, Kuala Lumpur, is back on 6.025; heard on West Coast 0900-1045 fade-out, best 0900-1000; is in the clear now. (Rosenauer) If it is still audible in East during May, best time to try for it would probably be 0630 when usually has news. ISWC, London, lists call ZGE.

Manchuria—Harbin, approx. 7.099, now has news 0840 instead of 0800; Harbin announces frequencies of 7.100 and 3.500 on s.w. in addition to 2 m.w. outlets. (Dilg, Calif.)

Martinique—Hagen, Ala., says Fort-de-France, 9.700, can be heard well between transmissions of WLWS, Cincinnati, that is at 1800-1900, in French. Heard in North Carolina by Ferguson early as 1740.

Mauritius—Nattugglan, Sweden, says Mauritius is heard on 40.87 metres (approx. 7.340) to 1215 when signs off with "God Save the King."

Monaco—Radio Monte Carlo seems regular now at 1400-1500 on 9.495. (Peddle, Newfoundland) Swedish sources say the m.w. outlet has been changed to 959 kcs., and that the s.w. transmitters on 6.035 and 9.494 both operate with 25 kw. power. (Swedish DX)

Mozambique—CR7BE, Lourenco Marques, recently appeared back on 9.715 from 9.708. (Stark, Texas) Still later has been heard both 0000-0100 and 0900-1100 on approximately 9.750. Rosenauer, California, informs me that this channel (he lists it approximately 9.745) is heard 1045-1100 sign-off with fine signal; at 1100 asks listeners to tune to 60- or 85-meter band as the 31-meter channel closes down then; however, some days at least the 9.745 one runs late as 1105. In the 0000-0100 transmission, the frequency appears to me to be 9.750, fine level, *English* announcements.

New Caledonia—Radio Noumea, 6.000, can be heard *after* Rabat leaves 6.005 at 0300 until after 0500 when fades out; announces at 0500 as "La Voix de la France" and has all-French program. (Hagen, Ala.)

Rosenauer, Calif., has received a letter from Le Directeur du Cabinet du Gouverneur General, Directeur du Service de l' Information, Noumea, *"La Voix de la France dans le Pacifique,"* Noumea, New Caledonia, in answer to airmail letter requesting confirmation of the change in fre-

quency to 6.000 and any changes in schedule. The official advised that 6.000 is the *correct* frequency and that there has been no change in schedule as given earlier—1200-2000, 0230-0400. This does not quite match the time Rosenauer has heard this station, sign-off having been 0500. He inquired as to current power output but received no answer to this query.

New Zealand—ZL3, 11.78, logged early as 1255 with orchestra; at 1300 announced ZL3 and ZL4 (15.28) and took relay of news from BBC; generally has "Breakfast Music" 1315, another BBC news relay 1400, followed by weather forecast 1415. (Pearce, England) Is used widely for relay of m.w. outlets; final closedown now appears to be around 0620 on *both* 11.78, 15.28.

Nicaragua—McPheeters, La., received verification from YNMG, *"La Voz de Jinotepe,"* 8.007; proprietor is a woman, Margarita E. Gomez; schedule is 1230-1400, 2000-2130 daily; suffers bad CWQRM; listed 100 watts.

YNDG, 7.660, heard 2000 announcing in Spanish and *English*, continued with music. (Ferguson, N. C.)

Northern Rhodesia—ZQP, Lusaka, heard in Ontario on 9.715 at 1030, high noise level, fast fading. (Alfred) Carl Rosenauer, Calif., has received a letter from Lusaka, signed by John F. Murray, the Broadcasting Engineer, in which it was stated:

"Although we are using a high angle, omni-directional aerial on 9.710, we have had a number of reports from California, Sweden, and Western Australia. It rather looks as though we have some secondary lobes at a low angle; until the field-strength measuring apparatus on order arrives, we can't do much about it. The power on 9.710 is 2.5 kw. into the aerial, which is of the Marconi 'Quadrant' type, that is, two half-wave sections at right angles to each other in the horizontal plane, thus giving an omni-directional horizontal pattern. The elements are a quarter-wave above ground so that, theoretically, there should be no low angle radiation. We are supposed to cover Southern Rhodesia, Northern Rhodesia, and Nyasaland from Lusaka, i.e. a five hundred mile radius centered on Lusaka, providing programs in the various vernaculars as follows—Monday 1000-1200 Chibemba; Tuesday 1000-1200 *English* for Africans; Wednesday 1000-1200 Chinyanja; Thursday 1000-1300 Silozi and Chitonga; Friday 1000-1200 Sindebele; Saturday 1000-1200 Euro-African Program; Sunday 0400-0530 European Program, and 1030-1130 African Religious Service. We also transmit on 7.220 and 3.914, but on 500 watts only on each of these frequencies." At press time, Rosenauer flashed to me that Lusaka now appears to be on about 9.700, at least is lower than Lourenco Marques and has good signal 1100-1130.

Norway—Worris, N. Y., has learned that "economic restrictions will limit short-wave transmissions to present

scope during foreseeable future. Currency restrictions made it necessary to use temporary, makeshift, homemade components in parts of the new 100 kw. transmitter." However, I understand several additional antennas are being erected at the present transmitters to broaden the range of the stations.

Oslo's LLN, 17.825, heard 0800-0830 with call in *English* and Norwegian; asks for reports to *Radio Norway*, Oslo, Norway; says also operating in 19-, 31-, and 41-m. bands (LKV, 15.170, LLG, 9.610 fairly good but the 41-m. channel of 7.240 is jammed by locals at this time). Now frequently announces in *English* 1500 on LLG, 9.61, and then gives frequencies for 19-, 25-, 31-, and 41-m. bands. (Pearce, England)

LLK, 11.850, heard 0130-0235 sign-off, fair level. (Balbi, Calif.)

LLS, 7.210, heard 1400-1500; LKJ, 9.540, Tromsoe, heard 0530-0615. (Peddle, Newfoundland)

Panama—HP5A, 11.695, Panama City, signs off 2245. (Beck, N. Y.) HP5B, 6.030, *Radio Miramar*, Panama City, now signs on a half-hour earlier, that is 0700; QRA seems to be Aptdo. 1214. (McPheeters, La.)

Philippines—Manila, 9.640, heard with station announcement 0700, gave new m.w. call of DZRH; sponsored dance session followed. (Ferguson, N. C.) This one heard recently in California at 1100-1130 with popular music and *English* announcements, good signal; call of s.w. outlet appears DZH2 (Rosenauer).

Portugal—Lisbon, 6.350, signs off 1900 in Portuguese to Brazil; formerly on 6.374; this is a different transmitter from the one used to North America on 6.374. (Beck, N. Y.) However, Pearce, England, says Lisbon is now using approximately 9.726 (instead of 11.027) at 1600-1800 for Brazil, with news in Portuguese 1605, 1745. May be using both 31- and 48-m. bands to Brazil.

CS2W1, 12.865, Parede, power 250 w., heard 1900-2000; QSL'd in 27 days from Radio Clube Portugesa, Parede, Portugal; card blue with gold lettering. (Alfred, Ontario)

Portuguese India — From Nattugglan, Sweden, comes a report of a verification from *"Emissora De Goa,"* Goa, giving current frequency as 9.610, with 500 watts power, and schedule of 0900-1000.

Portuguese Guinea—Bissau is definitely now on 6.997. (Kary) Has been heard on this channel at 1720 but has almost continuous CWQRM which generally blots out Bissau. (Pearce, England) Closedown remains 1800, when signs with *"A Portugesa."*

Rumania—Bucharest, 6.210, heard 1510 with news and talk in *English*. (Ward, England)

Under favorable conditions, the 9.252 channel can be heard in East at 1600 when has news; sign-off is 1630 now; has severe QRM. Is heard in Newfoundland by Peddle at around 1430-1540. Kary notes that uses 7-note

chime for identification purposes 1530 and 1600, that schedule is now an hour later than formerly, and that closes 1630 with choral music.

Salvador—McPheeters, La., has received verie from YSR, *"La Voz de el Salvador,"* 990 kcs. and 6.265; said using 900 watts on s.w. and 1,000 watts on m.w. channel; scheduled 1200-0000; also in network are YSF, *Radio Vanguardia*, 840 kcs. and 9.250; YSHQ, *"La Voz del Progreso,"* San Miguel (first two are in San Salvador), 950 kcs. and 6.500; YSA, *Radio Cultura*, a *new* station to go on the air shortly, 1,020 kcs. and 9.490, located at Santa Ana.

YSUA, 6.250, uses recording (in *English*) to announce call on half-hour and then returns to Spanish; announces *"Radio Mil Cincuenta";* appeared recently to be holding some sort of contest for listeners. (Weisberg, N. Y.)

Siam—From Johnston Island in the Pacific, Capt. F. Fellers informs me that the Overseas Broadcasting Station of Siam, Bangkok, now testing on 11.715 daily 0500-0630 in parallel with 6.010, has been heard by him on 11.715 with news 0515, *English* talk 0540, and news again 0615; signal good but has QRM from Australia's 11.71 and USA and Moscow; he cannot hear the 6.010 outlet due to terrific QRM from Noumea and South America. The 49-m. outlet, however, can be heard some days here in East in 0615 news; the 11.615 channel is "all noise" here in West Virginia 0500-0630. Reception reports on the 11.715 tests are requested, according to Desouza, Singapore, via *Radio Australia*.

South Africa—Pearce, England, says most reliable signal he has been getting from South Africa is Johannesburg, 4.895, heard from around 1230 to sign-off with *"Suid Afrika"* and "God Save the King" 1605, following the "11 p.m. Epilogue." Programs are all-Afrikaans; news in Afrikaans at 1500; *English* program on 4.800 at 1245 has poor intelligibility due to CWQRM.

Cape Town, 5.878, has had improved signal lately here, opening 2345 with *English* announcement, then goes into Afrikaans (setting-up exercises).

ZRB, 9.11, Pretoria, heard well recently, in clear, 0010 with setting-up exercises. (Bellington, N. Y.)

Spain—Radio SEU, EDV10, Madrid, is now back on 7.191 at 1400-1900. "La Voz de la Falange," 7.380, Madrid, has Spanish 1400-1530, 1700-1830, and French 1330-1400; much QRM from Moscow. *Radio Mediterraneo*, Valencia, verified by *(English)* letter, gave frequency 7.037.2, scheduled 0700-1000, 1400-1800; opens with march "Hacia Valencia," closes down with "Marcha de la Ciudad." (Pearce, England)

Surinam—PZC, 15.405, has Arabic Fridays 1900-1945 in parallel with PZH-5, 5.760. (Alfred, Ontario)

Switzerland—The Home Service from Berne at 0040-0140 is now on 6.165 (100 kw.) and 9.535 (instead of former 11.715). Berne signs off 1530 on 11.865 and 9.665 (new 100 kw.) in British Isles beam; returns 1545 on

11.865. (Beck, N. Y.) Berne's HER8, 21.520, heard 0745-0915. (Peddle, Newfoundland) The 9.665 channel heard with news followed by talk 1350-1400, only fair signal in North Carolina. (Ferguson)

Ward, England, confirms that *United Nations Radio*, Geneva, 6.672, has UN news in *English* daily (*except* Sun.) at 1330. Station informed Cushen, N. Z., that only the 6.672 transmitter is now in operation, is 7.5 kw. the 18.450 station is not now in use; stated "transmitters are still experimental, but as soon as budgetary considerations are increased, our services will be increased."

Syria—Sutton, Ohio, reports Damascus, 12.000, with music and Arabic 1200-1300, S6. Hagen, Ala., reports this one 0000-0100 with Arabic music, through heavy CWQRM. Is heard in North Carolina by Ferguson, opening in Arabic, followed by Eastern music. Confirmed by several other Eastern monitors lately.

ISWC, London, lists Damascus on 6.000, 7.500, and 12.000 with Arabic 0000-0100, 0630-0730, 1100-1455, *English* and French 0730-0830.

Tibet—I have asked an *ISW* monitor in Assam (India) to check on the rumor that a s.w. outlet is operating between 6 and 8 megacycles from Lhassa. *Any information on this "rumor" will be welcomed.*

Trinidad—Radio Trinidad, 9.625, Port of Spain, excellent opening 05.00. (Hankins, Pa.) Heard at that time "Down Under" by Sanderson of Australia. And in Ontario 1845 with news and sports, good signal, in clear, local news 1900, also heard 0545 with news. (Alfred)

United States—WVD, 6.980, Seattle, heard recently 0310 testing for receiver adjustment. (Alfred, Ontario) Recently heard on 14.867 at 1939-2018 by Starry, Pa.; stated "This is WVD, testing for the benefit of receiver tuning of our Northern stations"; played recordings between tests.

USSR—Home Service heard on 9.480, 9.645, 11.720, 11.880 with setting-up exercises 0000-0030, good level. The 15.410, 15.385 outlets heard with musical program 0030-0100. (Sutton, Ohio) Nattugglan, Sweden, lists Alma Ata, Kazakstan, on 9.625, opening 2000 in native and Russian, says closes 1000.

Soviets heard at 2300 and afterwards in Home Service include 6.020 (Kiev), 6.050, 7.270, 9.660. (Beck, N. Y.) Frequencies of 11.75 and 9.545 are used to China 0600-0700. (Balbi, Calif.)

Vatican—In summer, HVJ will have news 0900 on 15.095 and 9.660, at 1315 on 9.660 and 5.969; each Tuesday at 1000 will be on 17.445 for India and South Africa, news summary; each Sunday at 0430 on 9.660 and 5.969 with broadcast mass. (Ruglivedt, Norway) However, lately the 31-m. outlet appears to be low as 9.645, according to Pearce, England.

Venezuela—Radio Cabimas, YV1RC, 6.150, signs off 2235. (Beck, N. Y.) McPheeters, La., received verie-letter

from *Radio Barquisimeto; new* call-signs are YVMQ, 4.990, 4 kw., and YVMR, 1,475 kcs., 3 kw.; no schedule given; QRA Aptdo. Postal 76. McPheeters lists *new* call of *Radio Carora* as YVMU, 3.340, signs off 2130; says YVMG, *Radio Popular*, 4.810, Maracaibo, is scheduled 0600-2230; that *Radio Maracay*, 3.430, appears to sign off usually 0800; new callsign appears to be YVLI for the s.w. outlet and YVLJ for 930 kcs.

Yugoslavia—YUA, 6.107, Belgrade, has *English* 1545-1600. (Peddle, Newfoundland)

Unidentified—Alfred, Ontario, would appreciate identification of a station heard on approx. 9.560 at 2015 with tom-tom drums and African-type program.

An unidentified station on 6.150 has Arabic around 2300 and later; definitely is *not* Sharq-al-Adna which is heard on 6.170 with slightly better signal. (Beck, N. Y.) This may be Teheran, Iran, listed 6.155V.

* * *

Last-Minute Tips

"Ici Radio Algiers" was heard in February on 15.200 both during Arabic before 1500 and French from that time, same program as *Radio Algiers*, 9.570; occasional breaks in program; not heard since so may have been a test or a spurious transmission. (Pearce, England)

In a recent Swedish DX session from Stockholm it was reported that Jerusalem, 8.100, had *not* closed down as previously reported but had been heard 1330 when carrying same program as Kol-Yisrael, 6.820, Tel Aviv.

A station heard opening 0000 on approximately 8.017 is believed to be *Radio Beirut*, Lebanon; has had QRM. (Stark, Texas)

Radio Makassar, Celebes, heard recently on 9.550 from tune-in 0715 to fade-out 0900, mainly in Indonesian-Malay; the 11.086 channel was somewhat weaker, faded out earlier, and did *not* carry same program as 9.550. (Kary)

A *new* s.w. transmitter at Waneroo, Australia, to be used in Inland Service of ABC, may be operating around the middle of this year. *(Radio Australia)*

Nattugglan, Sweden, lists Hyderabad (India) on 6.110. *Can anyone confirm?*

COKG, Cuba, runs 500 watts; QRA is Apartado 82, Santiago de Cuba, Cuba. (Weisberg, N. Y.)

A Czech listener reported recently to *Stockholm Radio* that *Radio Venezia Guilia* is a clandestine (Italian) station operating on 6.400, signing off 1500. (Swedish DX)

Desouza, Singapore, reports *"The Voice of Sumatra"* on 7.650 daily 0730-0830; Javanese 0730-0800, news 0800, last 15 minutes in Indian dialect.

Hankins, Pa., has received verification stating *definitely* that *Juliana Sender, Willemstad*, Curacao, has been operating on 5.010 as well as 2.315 since December 1, 1948; the 5.010 is the exact frequency reported by Hankins. Manager of station CUROM,

Jan Doedel, stated "our broadcast in *English* is now Mondays 2000-2015." The 5.010 outlet is also reported heard by Peddle, Newfoundland.

Ferguson, N. C., received this data from Direction Centrale de la Radiodiffusion D'Albane, Rue Conference de Peza 3, Tirana, Albanie; *Radio Tirana,* ZAA, 7.850, scheduled 1200 news in Russian; 1315 news in Roumanian; 1330 news in Italian; 1345 news in French; 1400 relays with m.w. for rebroadcast the news in Albanian; 1415 news in Greek; 1430 news in Bulgarian; 1445 news in Turkish; 1500 news in Serbo-Croat; 1515 news in *English;* 1530 program for Albanians abroad; 1600 end of transmission.

In a DX broadcast from Leopoldville this data was given concerning *Radio Congo Belge*—OTM-1, 6.295, 0000-0200, 0500-0700, 1100-1500; OTM-2, 9.380, 0000-0200, 0500-1500; OTM-4, 11.720, 0515-0700; broadcasts in French, Spanish, and Portuguese to Europe. OTH was given on 9.210 at 1230-1330 in French and Congo dialects, power 15 kw. QRA is Radio Congo Belge, P. O. Box 171, Leopoldville, Belgian Congo. (Novomestky, Puerto Rico, and Cooley, Pa.)

Wooley, N. J., flashes that Denmark's 9.52 is now fine strength at 2015.

McPheeters, La., recently reported hearing Podebrady, Czechoslovakia, on 11.900 around 2300-0100, appeared to use trumpets played on Praha II. OLR4D, Prague, is listed 11.900 as "inactive."

The *Azad Kashmir Radio,* 6.230, Rawalpindi (with transmitter at Trarkhel) has not been reported for some time and is presumed to be off the air. This is probably the station referred to abroad (near end of 1948) as believed to be *Radio Pakistan.*

The Government of India is progressing in its Eight-Year Plan for expansion of broadcasting facilities. Many new high-powered stations (presumably on m.w.) are under construction and it is presumed some s.w. ones will be included in the plan. A news release from the Indian Embassy recently stated: "High-powered radio transmitters will soon be installed at Delhi, Bombay, Madras, and Calcutta. Pilot stations have already opened at Cuttack, Shillong, Gauhati, Nagpur, Vijayawada, and Allahabad. Giving further information on the government's eight-year program for the expansion of broadcasting facilities, the Information Minister said in Parliament on February 4 that a radio station at Ahmedabad would begin to function by the end of March 1949 and that pilot stations at Jullundur, Dharwar, and Calicut would be completed by June. The 8th new radio station of India since its independence went on the air on February 1 at Allahabad." (Joshi, W. Va.)

* * *

Acknowledgement

Thanks for the FB reports this month, fellows! Keep them coming to 948 Stewartstown Road, Morgantown, West Virginia, USA.—K.R.B.

AFCA NEWS

This Association is a patriotic non-profit organization, with chapters in most of the larger cities, dedicated to developing and maintaining efficient personnel, commissioned, enlisted, civilian, for the supply (including design and development), installation, maintenance and operation of communications and electronic equipment for Army, Navy and Air Force and their supporting civilian activities. It publishes a magazine "SIGNALS" at its national headquarters in Washington. Every American interested in any way in communications is eligible and invited to join. Further details may be obtained by addressing the secretary at 1624 Eye St. N.W., Washington 6, D. C.

AFCA CHAPTER NOTES

Baltimore

The March 3rd meeting of the Baltimore Chapter was held at Station WBAL of Baltimore and featured a broadcast of an address by Colonel Kirke B. Lawton, Deputy Chief Signal Officer of the Army, in commemoration of the 86th anniversary of the Signal Corps. Present as guests of honor were Admiral Earl E. Stone, Chief of Naval Communications, and Major General Francis L. Ankenbrandt, Director of Air Force Communications. At 6:15 p.m., Clinton H. Johnson, chapter member, interviewed Colonel Lawton, Admiral Stone, General Ankenbrandt and other distinguished guests on the WBAL Television. At 7:15, Colonel Lawton's address to the chapter was carried over the NBC network. Due to studio accommodations, the audience was limited to 160. The broadcast was followed by a tour through the station and included both TV and standard broadcast facilities.

Cleveland

A tour of the facilities of the Acme Telectronix Division of the Newspaper Enterprise Association Service, Incorporated was the feature of the March 10th meeting of the Cleveland Chapter. The primary interest in this program was the preparation and handling of news and transmission of pictures by wire for newspapers.

Far East

The charter of the Tokyo Post of the Far East Chapter was presented by Brig. Gen. George I. Back, President of the Far East Chapter, at a meeting of the post on January 25th. A post constitution was adopted and officers were elected as follows: Chairman: Lt. Col. W. D. Dillinger; 1st Vice-Chairman: Col. R. S. Carter; 2nd Vice-Chairman: Chief W. A. Whaley; Secretary: Maj. R. P. Zebley; Treasurer: Capt. I. Koss.

Kentucky

Chapter members met on February 18th at the Stirrup Cup in Lexington to commemorate the 86th anniversary of the founding of the Signal Corps. After the dinner, a Signal Corps birthday cake was cut in traditional style—with a saber—by the past president, Col. William M. Mack, assisted by the new president, Murray P. McQuown.

Lt. Col. Robert H. McAteer of the Military Department of the University of Kentucky addressed the group on the "Evolution and History of the Signal Corps." After Col. McAteer's talk, Mr. William Prewitt, a Lexington businessman and one of the members of Company B of the 113th Field Signal Battalion, which was organized in Lexington at the start of World War I, gave a very interesting and humorous sketch of the history of the 113th Field Signal Battalion.

The meeting closed with the showing of the film "Westward is Bataan."

New York

A concrete example of the real meaning of the unification of the Armed Services was presented to a joint meeting of the New York Chapter and the New York Volunteer Reserve Electronic Warfare Company on February 9th. The main meeting room of the historic Seventh Regiment Armory was filled to capacity with Army, Navy and Air Force, regular and reserve personnel, and representatives of the communications industry in New York.

After opening remarks by Chapter President George P. Dixon, Capt. Aubrey Wyckoff, USNR, was introduced as Commander of the Naval Reserve Unit participating. The chairman then introduced in turn Major General Spencer B. Akin, Chief Signal Officer of the Army; Rear Admiral Earl E. Stone, Chief of Naval Communications; and Major General Francis L. Ankenbrandt, Director of Air Force Communications; each of whom gave a short address concerning communications in his branch of the service. The talks by the communications chiefs were enthusiastically received. Following the meeting, dinner was served to the largest chapter turnout since the 1947 annual AFCA meeting held in New York.

Philadelphia

On March 3rd, the Philadelphia Chapter also celebrated the 86th anniversary of the Signal Corps at its

dinner meeting at the Officers Club of the Philadelphia Quartermaster Depot. After introducing the distinguished guests, Chapter President W. W. Watts called on Col. Benjamin Stern, head of the Signal Corps Procurement Agency, who outlined the assistance which he believed AFCA could give to his activity. Brig. Gen. S. H. Sherrill, National Executive Director, spoke briefly on the activities of other chapters. Col. A. M. Shearer, Deputy Chief of Distribution and Procurement Service, OCSigO, was the principal speaker and outlined the history of the Signal Corps since it was founded in 1863 by Col. Myer.

Richmond

Members of the Richmond Chapter met on February 23rd at the Pantree in Richmond. Capt. E. L. Gibson, USAF, Langley Field Communications Center Officer for the Tactical Air Command, was the guest speaker. His subject was "Communications within the Tactical Air Command."

Southern California

The Southern California Chapter is now meeting regularly on the second Thursday of each month. The January 13th meeting was addressed by Col. Martin Shakeley, of the California National Guard, on the subject of ground defense against atomics. Col. Shakeley commands a brigade charged with the immediate organization of such measures as are feasible for controlling and supervising matters in the case of such an attack. He held a discussion period after his talk which the members felt was of immeasurable value.

The feature speaker for the February 10th meeting was Lt. Col. Ralph A. Pender, who commanded the First Combat Camera Unit with the 15th Air Force and MAAF during the past war. Col. Pender showed pictures made by his units of the air attacks on Ploesti and discussed problems of aerial photography of this nature. —30—

VWOA AWARDS CITATIONS

FOUR citations were awarded by the Veteran Wireless Operators Association, Inc., at the 24th annual dinner-cruise February 26. At the Hotel Astor in New York, radio officers A. T. Newberg "SS Gulfstream," Clarence H. Scruggs, United Fruit Steamer "Junior," and Arthur E. Murray, Bull Steamship Co. "Suzanne" were cited in recognition of meritorious service and excellence in radiotelegraph operation aboard their vessels while assisting in the rescue of the crew of the cutter "Eastwind," after it had collided with the oil tanker "Gulfstream" on January 19, 1949.

A citation was also presented to Mr. Raoul E. Cowden of the "SS Mormacrey" for meritorious service during the distress of the British tanker "Adellen" early in January. Mr. Cowden was highly commended for service beyond the call of duty when he remained on watch aboard ship for 72 hours, handling distress messages for the disabled vessel. —30—

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MISCELLANEOUS

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TECHNICAL Report No. 101. Practical Transformer design, construction and repairing. $2.00 Postpaid. Conrad Roeschke, Buckhorn, New Mexico.

27 YEARS of experience Radio Repairing. Simplified system. No calculations. No formulas. Total price $2.00 postpaid or C.O.D. Moneyback guarantee. Ross Radio, 14615 Grandriver, Detroit 27, Mich.

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CRYSTAL Set—Telephone combination, diagram and instructions, 25c. Includes attractive offer, literature, year's membership in "XTAL-X Crystal Set Club," Box 608, Torrance, Calif.

ANY Radio, electronic Text Book rented, 1-2c per day. Address: TBRA, 780 E. 214th St., New York, N. Y.

RADIOMEN, Servicemen, Beginners. Make more money, easily, quickly. $250 weekly possible. We show you how. Information free. Merit Products, 216-32R 132 Ave., Springfield Gardens 13, N. Y.

INDEX OF *Advertisers*

MAY 1949

While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.

PEORIA "HAMS" HOLD PICNIC

H. C. SEVER, acting secretary of the Peoria Amateur Radio Association, announces that it will hold its "Annual Hamfest" on June 12, 1949, at Woodland Knolls, which is located approximately 4½ miles east of McCluggage Bridge, near Peoria.

The members will bring their own basket lunches, but arrangements have been made for contests, sporting events, and lots of other entertainment. The Peoria ARA hopes to have a large turnout and has appointed H. E. Callander, 211 E. McClure, Peoria, Illinois, to answer all inquiries of those interested in joining the festivities. —30—

TV SET PRODUCTION

DESPITE a shortage of cathode-ray tubes, which retarded production in some instances, February television receiver output was approximately at the same level as January, the Radio Manufacturers Association reported today. TV receivers produced by RMA member-companies in February numbered 118,938, slightly below the 121,238 sets manufactured in January.

Coincident with the decrease in all set production, the number of FM-AM and FM receivers produced in February dropped to 98,969 from 147,733 in January. Adding our usual 10 per-cent for non-RMA members will bring the total of television sets produced in January and February to approximately 133,362 and 130,832, respectively. —30—

ERRATUM

Footnote[1] on page 62, April issue, is in reference to the Cataldo & Richard article entitled "Servicing Simplified," published in the January, 1949, issue of RADIO AND TELEVISION NEWS.

PHOTO CREDITS

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47, 70	Radio Corporation of America
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49 (Figs. 7 & 8)	North American Philips Co., Inc.
50	Acme
53 (Top)	Flexible Co.
53 (Bottom)	Oklahoman and Times
60, 61	McMurdo Silver Co., Inc.
64	(Left) The Hallicrafters Co. (Center) Sentinal Radio Corp. (Right) Tele-Tone Radio Corp.
68, 69	Burton Browne Advertising
138	U. S. Army
146	U. S. Navy
147	Sun Radio & Electronics Co., Inc.

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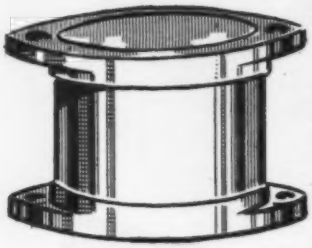
PARTS SHOW VISITORS:

Be sure to visit our tremendous showrooms at 320 N. LaSalle St. Thousands of electronic components conveniently displayed.

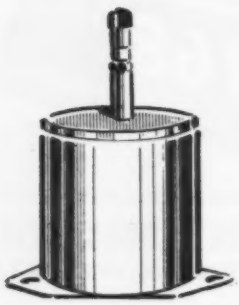
SPECIAL LOW PRICES FOR IMMEDIATE SALE AND DELIVERY

We have literally hundreds of thousands of these top quality standard type transmitting mica condensers in stock for immediate delivery at a fraction of their original cost. Every condenser is brand new and carries the name of a fine nationally known manufacturer.

Despite the unusually low prices, these mica condensers, like all Wells Components, are fully guaranteed. Be sure to order sufficient quantities for your requirements.



STYLE "AA"



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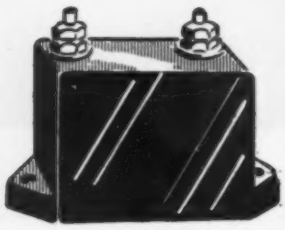

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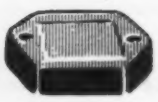

STYLE "C"

STYLE "D"

Cap. Mfd.	Wrkg. Volts	Mfr. Leg.	Price Each
STYLE "AA" CONDENSERS			
.02	3000	2	$4.50
.04	1000	2, 7	3.50
STYLE "A" CONDENSERS			
25mmfd	10000	8	$1.65
STYLE "B" CONDENSERS			
.00003	2000	2	$0.70
.000047	3000	1	.80
.00005	3000	2, 9	.75
.00007	1140	6	.70
.00009	3000	2, 7, 9	.75
.000091	3000	7	.80
.0001	3000	2, 7, 9	.80
.000107	3500	1	.85
.00011	3000	8	.95
.00137	3000	2	.95
.000175	1500	8	1.00
.0002	1430	6	1.00
.0002	3000	7, 8	1.00
.0002	5000	1, 8	1.05
.00025	5000	7	1.10
.0004	3000	2, 7	.95
.0004	5000	2, 7, 8	1.10
.0004	6000	1	1.55
.0005	2000	7	.95
.0005	3000	3	1.00
.00051	3000	7	1.00
.00055	3000	7	1.10
.0006	2500	7	1.05
.0006	5000	8	1.15
.000625	3000	7	1.05
.0007	3000	7	1.05
.00075	2500	2	1.05
.00075	5000	8, 9	1.15
.0008	3000	7	1.00
.0008	5000	2, 8	1.15
.001	4500	2, 9	1.25
.001	5000	7, 8	1.30
.0011	5000	2, 7	1.35
.00125	2000	7	1.10
.0014	5000	2	1.35
.0015	3000	7	1.10
.0024	3000	8	1.15
.0025	2000	1, 2, 7	1.10
.00275	2000	1, 7	1.10
.003	2000	7	1.20
.004	3000	2, 8	1.50
.005	2000	2	1.40
.005	5000	6, 8	1.70
.006	2500	7	1.30
.006	3500	8	1.45
.0068	3000	8	1.40
.008	3000	7, 8	1.45
.01	2000	1, 2, 3	1.55
.01	1000	7	1.35
.02	600	7	1.30
.02	2000	2, 8	1.60
.024	1500	3	1.60
.033	1500	3, 7	1.60
.056	1000	3, 7	1.70
.06	1000	8	1.70
.1	1000	8	1.75
STYLE "C" CONDENSERS			
.000005	2500	2	$0.40
.00005	600	7, 8	.30
.0001	600	2, 7	.25
.0001	1200	7	.35
.0001	2500	4, 7, 8	.40
.0002	600	2, 7, 9	.25
.0002	2500	7	.40
.00024	2500	7, 8	.45
.00025	2500	2	.45
.0003	2500	7	.45
.00039	2500	7	.50
.0004	2500	2, 7, 9	.45
.0005	600	1, 7	.35
.0005	1200	2, 7	.40
.0005	2500	1, 2	.45
.001	1200	2, 7, 8	.40
.001	2500	6, 7	.55
.001	3750	7	.85
.0011	600	2	.35
.002	600	7	.35
.002	1200	2	.45
.002	2500	1, 2, 8	.55
.002	3500	8	.80
.0022	2500	7	.60
.003	600	8	.40
.0035	2500	7, 9	.60
.0039	2500	2	.60
.004	2500	2, 7	.60
.0045	600	8	.40
.0046	500	9	.45
.0047	2500	8	.65
.005	600	2	.35
.005	1200	7, 8	.45
.005	2500	7, 8	.60
.0051	1200	7	.45
.0051	2500	7, 8	.65
.0056	2500	8	.65
.006	600	7, 9	.40
.006	2500	7	.65
.0068	1200	7	.60
.007	600	8	.35
.0075	1200	2	.55
.009	600	9	.50
.01	600	2, 7, 8	.40
.01	1200	3, 7, 8	.45
.01	2500	7, 8	.60
.0115	600	8	.40
.013	1200	3	.55
.015	1200	7	.55
.015	2000	8	.60
.015	2500	7, 8	.60
.0175	1200	2	.55
.02	600	7	.35
.02	1200	7	.45
.022	1200	7	.45
.025	600	8	.35
.03	600	6	.35
.03	1200	2, 8	.50
.033	600	7	.35
.033	1200	8	.50
.04	600	7, 8	.35
.073	250	8	.40
STYLE "D" CONDENSERS			
.00004	600	7	$0.20
.00005	1200	1, 7, 9	.25
.00005	2500	2, 8, 9	.30
.0001	600	9	.20
.0001	1200	7, 8	.25
.00015	2500	2, 6	.35
.00024	2500	6	.35
.00025	1200	6, 8	.25
.00025	2500	6, 8	.35
.0005	1200	7	.30
.00051	2500	1	.35
.0007	600	2	.25
.001	600	2, 8	.25
.001	1200	6, 8, 9	.35
.001	2500	6, 8	.40
.0011	2500	8	.40
.002	600	1, 2, 9	.25
.002	1000	8	.30
.002	1200	6, 7, 8	.35
.002	1250	1	.35
.002	2500	8	.40
.0022	1200	8, 7	.30
.0022	2500	8	.40
.0025	600	2	.25
.0025	1200	1	.30
.0027	600	1	.25
.003	600	2	.25
.003	1200	6, 7, 8	.30
.0033	1200	6	.30
.004	1100	8	.35
.004	1200	7, 8	.35
.004	2500	9	.45
.0044	600	8	.25
.0047	2500	6, 8	.40
.005	600	2, 6, 7	.25
.006	600	1, 2	.25
.01	600	2, 7, 8	.30
.01	1200	6, 7, 8	.40
.01	1250	1, 6, 9	.40
.01	2500	2, 8	.50
.02	600	2, 6, 8	.25
.022	600	7	.25
.025	1200	7	.35
.027	600	7	.25
.03	600	2, 8	.25
.05	600	7	.30

Manufacturers' Legend

1—Aerovox; 2—Cornell Dubilier; 3—Faradon; 4—General Electric; 5—Illinois; 6—Mica-Mold; 7—Sangamo; 8—Solar; 9—Sprague

This is only a partial listing. Write or wire for information on types not shown and for receiving set micas and silver micas.

We advise distributors to order immediately from this ad. Our standard jobber arrangement applies.

Manufacturers and Distributors: Write for our complete Mica Condenser Listing No. 103A.

WELLS SALES, INC.

320 N. LA SALLE ST., DEPT. R-5, CHICAGO 10, ILL.